

An illustrated type catalogue of *Diplommatina* Benson, 1849 from mainland China, with description of a new species, *Diplommatina yipingica* (Gastropoda, Cyclophoroidea)

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Abstract

We document type material of 41 nominal species from mainland China that were originally assigned to *Diplommatina*. This catalogue is based on inspection of the Heude Type collection in the National Zoological Museum of China, Beijing and complemented with information on types held by other international museums from a comprehensive literature review. We designate lectotypes of five nominal species, *Diplommatina abbreviata* Heude, 1890, *D. confusa* Heude, 1885, *D. intermedia* Heude, 1890, *D. minuscula* Heude, 1890, *D. pupinella* Heude, 1885 and *D. pyra* Heude, 1885.

In addition, a new species, *Diplommatina yipingica* Zhang, **sp. nov.**, is described from Qingdao City, Shandong Province. A new name, *D. yunnanensis*, is introduced for *Diplommatina minuscula* Chen & Zhang, 1998, which is a junior homonym of *D. minuscula* Heude, 1890.

Key Words

Diplommatinidae, nomenclature, Shandong Province, *Sinica*, type material

Introduction

Diplommatina Benson, 1849 is a speciose genus containing species from Asia and the Pacific (Webster et al. 2012). With its evolutionary origins estimated to date back to the early or mid-Cretaceous, the genus is of considerable evolutionary antiquity (e.g., Köhler 2023). Several species from mainland China were described by early European malacologists, such as Gredler (1881, 1884, 1885, 1886, 1887a, 1887b), Möllendorff (1882, 1885a, 1885b, 1886) and Heude (1885), while comparatively few contemporary

studies have since complemented our knowledge of the Chinese fauna. Indeed, a comprehensive taxonomic review of the Chinese diplommatinids that goes beyond the appraisal of shell features is long overdue. Type specimens are critical to any such revision. As the bearers of taxonomic names, they will facilitate future assessments of the validity of taxa (Winston 1999). Relevant types for many Chinese species are scattered across museums in China, North America and Europe. This means that a compilation of the known type repositories will be a valuable resource for future revisions. We found that the following museums have

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important type collections of Chinese diplommatinids: the National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences (IZCAS) (containing significant parts of the Heude collection), the Museum of Comparative Zoology, Harvard University, Cambridge, USA (MCZ) (containing part of the Heude collection); the Naturmuseum Senckenberg, Frankfurt (SMF) (for types by Möllendorff and Yen); Academy of Natural Sciences of Drexel University, Philadelphia (ANSP) (containing the Pilsbry Collection), the Sammlung des Franziskaner-Gymnasiums, Bozen (containing the Gredler Collection; Zilch (1974)) and the Smithsonian National Museum of Natural History, Washington (UNSM).

Before the mid-20th century, taxa were generally described by European authors, such as Gredler (1881, 1884, 1885, 1886, 1887a, 1887b), Möllendorff (1882, 1885a, 1885b, 1886), Heude (1885, 1890), Schmacker and Boettger (1890), and Yen (1939). In addition, Pilsbry and Hirase (1908) described species based on specimens received from mainland China. Based on these works, Zilch (1953, 1974) compiled a checklist of *Diplommatina* from mainland China. Since then, six works by Chinese authors have been published adding to the documentation of *Diplommatina* species in China (Chen et al. 1994; Ran et al. 1999; Chen et al. 2001; Chen et al. 2002; Hu et al. 2003; Zhou et al. 2005; Luo et al. 2008). However, in many of the works, the internal shell sculpture, which is taxonomically relevant, has not been adequately documented. Overall, more

than 30 species and subspecies of *Diplommatina*, have been described from mainland China, with most of them occurring in southern China. Luo et al. (2008) suggested that the genus is narrowly distributed in southern China with the highest taxonomic diversity found in Hunan and Hubei Provinces and Chongqing City (Fig. 1). This statement requires confirmation by future research.

All diplommatinid genera are presently delimited using certain shell characters, such as coiling direction, shell shape, size and external and internal sculpture (Möllendorff 1885b; Schmacker and Boettger 1890; Kobelt 1902; Thiele 1929; Wenz 1939; Luo et al. 2008; Hwang et al. 2009; Egorov 2013; Liew et al. 2014; Neubert and Bouchet 2015; Budha et al. 2017; Greke 2017; Nurinsiyah and Hausdorf 2017), as well as operculum morphology (Kobelt 1902; Yamazaki et al. 2013; Budha et al. 2017) and radula (Yamazaki et al. 2013). All Chinese species known at the time were placed in the subgenus *Sinica* by Kobelt (1902: 455) based on the configuration of internal plicae. However, more comprehensive molecular studies are required to confirm the diagnostic value of these features in diplommatinid systematics (Webster et al. 2012). Molecular phylogenetic studies have shown that most genera of Diplommatinidae are monophyletic and have associated mapped morphological traits, but the phylogenetic relationships of some genera remain unclear, such as *Diplommatina* (Webster et al. 2012; Köhler 2023). The present study provides molecular data for one species as well as a detailed description of its morphology.

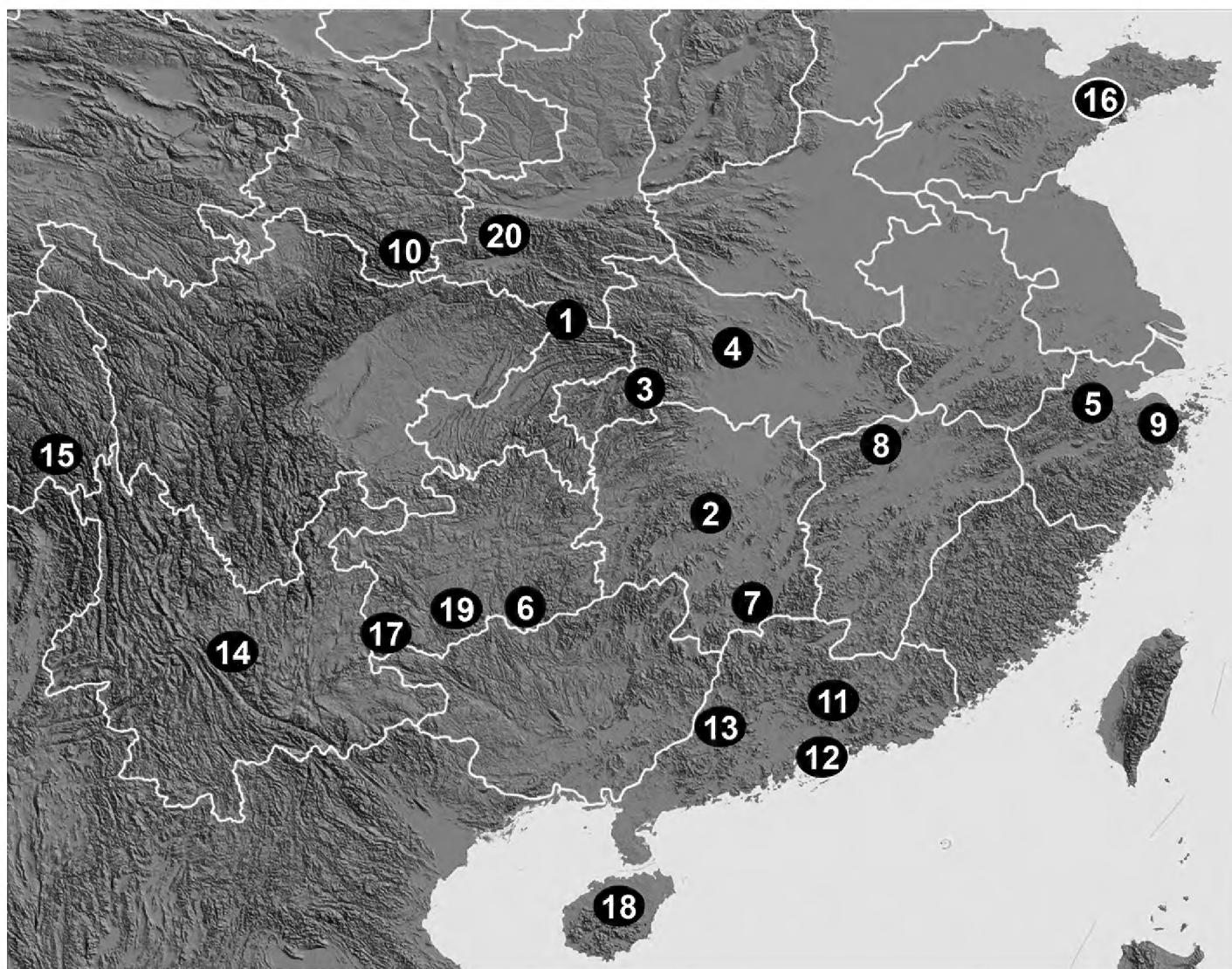


Figure 1. Type localities of *Diplommatina* species. 1. Chengkou, Chongqing City; 2. Hunan Province; 3. Badong, Hubei Province; 4. Hubei Province; 5. Hangzhou City, Zhejiang Province; 6. Libo, Guizhou; 7. Mangshan Hunan; 8. Lushan, Jiujiang City, Jiangxi Province; 9. Dalanshan, Ningbo City, Zhejiang Province; 10. Kangxian County, Longnan City, Gansu Province; 11. Luofushan, Huizhou City, Guangdong Province; 12. Dapengwan, HongKong City; 13. Zhaoqing City, Guangdong Province; 14. Yunnan Province; 15. Xizang Autonomous Region; 16. Laoshan, Qingdao City; 17. Xingyi City, Guizhou Province; 18. Hainan Province; 19. Luodian County, Guizhou; 20. Longxian County, Shaanxi Province.

Material and methods

Abbreviations used

ANSP– Academy of Natural Sciences of Drexel University, Philadelphia, USA; **FMB**– Franziskanermuseum Bozen, Italy; **HMT** - Heude Museum Type Collection, IZCAS, China; **MCZ** – Museum of Comparative Zoology, Harvard University, Cambridge, Mass., USA; **IZCAS** – National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, Beijing, China; **SMF** – Naturmuseum Senckenberg, Frankfurt/Main, Germany; **USNM** – United States National Museum, Smithsonian Institution, Washington D.C., USA.

Methods

Our terminology for shell features follows Budha et al. (2017). Map of all type localities is shown in Fig. 1. The shell photographs, showcasing both the apertural and lateral views, were captured using a Keyence VHX-1000C Large depth-of-field 3D Digital Microscope.

We used morphometrics and molecular phylogenetics to determine the similarities and differences between the proposed new species *Diplommatica yipingica* and all other examined type specimens of congeners. Shell morphological variation was assessed using geometric morphology methods (GMM): Landmarks and semi-landmarks were defined along the contour of the shell in apertural view and analysed by using tpsUtil32 software (Rohlf 2004), tpsDig32 (Rohlf 2005) and MorphoJ version 1.07a (Klingenberg 2011) (Fig. 2). The following landmarks (“LM”) were used: LM 1: Apex of shell; LM 2 & LM 7: Right and left terminal points on penultimate suture, respectively; LM 3 & LM 6: Right and left terminal points on last suture, respectively; LM 4 & LM 5: Crossing of peristome and left and right profile of body whorl. Semi-landmarks: Eight equidistant semi-landmarks (LM 8 – LM 15) between LM 2 and LM 3; eight equidistant semi-landmarks (LM 16 – LM 23) between LM 3 and LM 4; eighteen equidistant semi-landmarks (LM 24 – LM 41) between LM 4 and LM 5; eight semi-landmarks (LM 42 – LM 49) between LM 5 and LM 6; eight semi-landmarks (LM 50 – LM 57) between LM 6 and LM 7. Shape was assessed using principal component analysis (PCA) across all specimens and all landmarks. Discriminant analysis used cross-validation and 1,000 permutations amongst groups based on the phylogenetic groups. In addition, a canonical variance analysis (CVA) is used, which simplifies descriptions of variation according to the phylogenetic groups.

Whole genomic DNA (for SDNU specimens) was extracted from a piece of the foot muscle following the instructions of the manual (Tiangen DP316). PCRs were conducted in volumes of 25 µl each containing 12.5 µl of cwbio 2× Es Taq MasterMix Dye, 9.5 µl of ddH₂O, 1 µl



Figure 2. Shell photo showing landmarks used in this study.

of template DNA and each 1 µl of PCR primers (10 µM). Reactions were performed in a SimpliAmp™ Thermal Cycler using the following thermal cycling profile: Initial denaturation for 30 s at 94 °C, 40 cycles of each 10 s at 94 °C, 50 s at 45 °C and 50 s at 72 °C and a final extension at 72 °C for 10 min (for 16Sar and 16Sbr; Palumbi et al. (1991)). PCR amplicons were inspected on a 1% agarose gel for quality and fragment size, then were purified and sequenced on an automated sequencer.

The chromatographs and sequences were assembled in pregap4 1.6 and gap4 4.11.2 (Staden et al. 2003) with visualisation by trev 1.9 (Bonfield et al. 2002). DNA sequences were aligned using MAFFT 7.526 (Nakamura et al. 2018). We used Gblocks 0.91b (Castresana 2000) to remove ambiguously aligned parts of the multiple sequence alignment. The best-fit model of sequence evolution was selected by using ModelTest-ng (Kozlov et al. 2019) based on the Bayesian Information Criterion (BIC). Bayesian Inference was performed using MrBayes version 3.2.7 (Ronquist et al. 2012). We performed two Markov Chain Monte Carlo run-seach of them containing four chains (3 heated and 1 cold) for a total of 400,000 generations. Sampling rate was 100 generations. The temperature was set as 0.1. The first 50% of trees were discarded as burn-in.

Results

Morphological examinations of shell

Principal Component Analysis (PCA) of all individuals and all landmarks showed that 70.6% of observed morphological variance was explained by the first two principal components (PC1:60.8%; PC2:9.8%). The PCA plot showed that *Diplommatina yipingica* is similar to *D. pupinella*, *D. futilis*, *D. intermedia*, *D. paxillus longipalatalis*, *D. paxillus hunanensis*, *D. yunnannensis* and *D. schmackeriana* in terms of general shell shape. The Canonical Variate Analysis (CVA) identified 41% of observed morphological variance and was explained by the first two major axes of variance to account for a relevant proportion of variance (CV1:23.3%; CV2:17.7%). In contrast, the CVA plot showed *D. yipingica* cluster together, separated with remaining species (Fig. 3).

Molecular phylogenetic analyses

Sequences from 20 individuals of *Diplommatina* spp. and two individuals from the outgroup genus *Palaina* were used for phylogenetic reconstruction. The final concatenated dataset of the alignment of 16S sequences had a total length of 424 bp (76% of the original 556 positions). Based on the phylogenetic tree presented herein (Fig. 4), *Diplommatina* is a monophyletic group with maximal nodal support (Bayesian posterior probability = 1). *Diplommatina* forms a polytomy of three main lineages. This topology is consistent with a phylogenetic tree published by Boonmachai et al. (2023). *Diplommatina yipingica*, Zhang, sp. nov. belongs to the *Diplommatina* group (Clade A) known from China, Borneo, Malaysia and Thailand first identified by Webster et al. (2012).

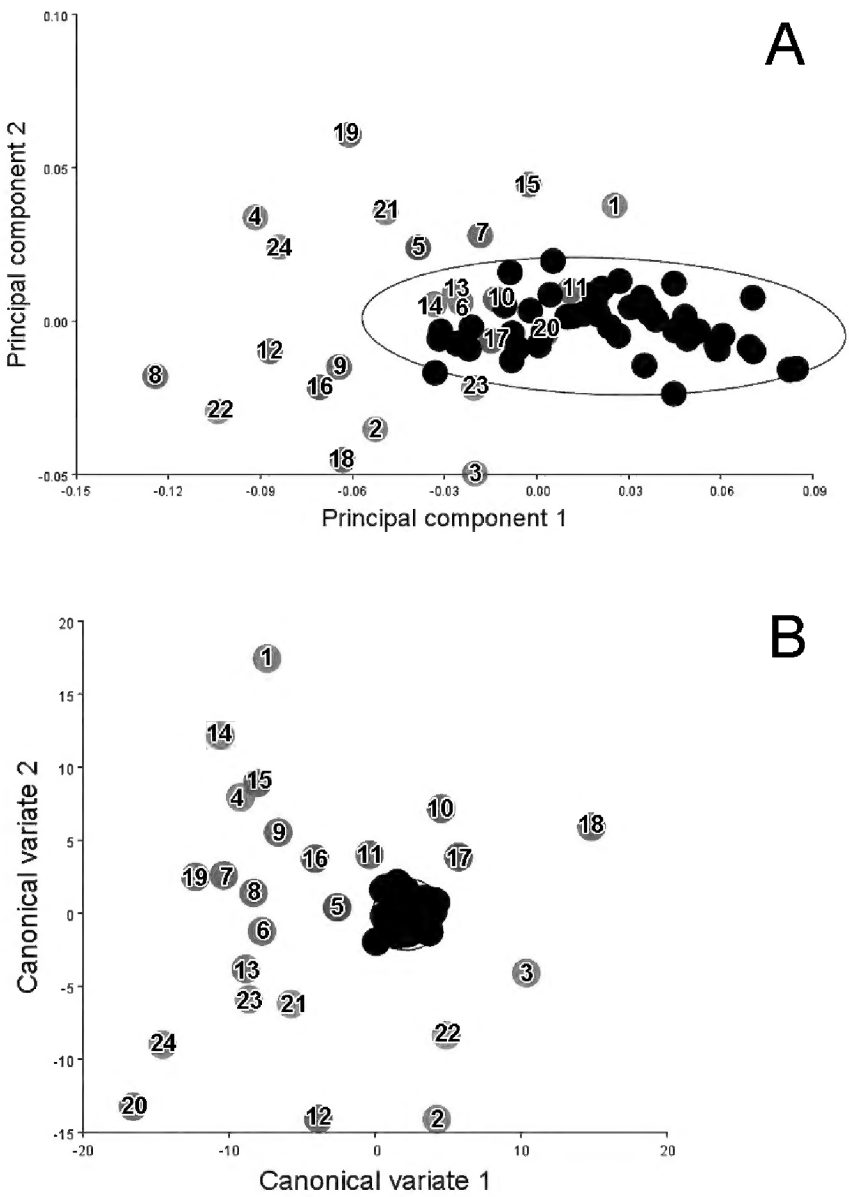


Figure 3. Scatter plots of GMM analysis. **A.** Scatter plots of PCA scores based on the data from apertural views of the *Diplommatina* species; **B.** Scatter plot of CVA of the geometric data. 1 *D. abbreviata*; 2 *D. confusa*; 3 *D. conica*; 4 *D. contracta*; 5 *D. cristata*; 6 *D. futilis*; 7 *D. hangchowensis hangchowensis*; 8 *D. hangchowensis granum*; 9 *D. inermis*; 10 *D. intermedia*; 11 *D. hunanensis*; 12 *D. paxillus* var. *robusta*; 13 *D. longipalatalis*; 14 *D. minuscula*; 15 *D. mucronata*; 16 *D. paxillus*; 17 *D. pupinella*; 18 *D. pyra*; 19 *D. rufa*; 20 *D. schmackeriana*; 21 *D. sculptilis*; 22 *D. setchuanensis*; 23 *D. subcylindrica*; 24 *D. triangulata*. Black dot is *D. yipingica*.

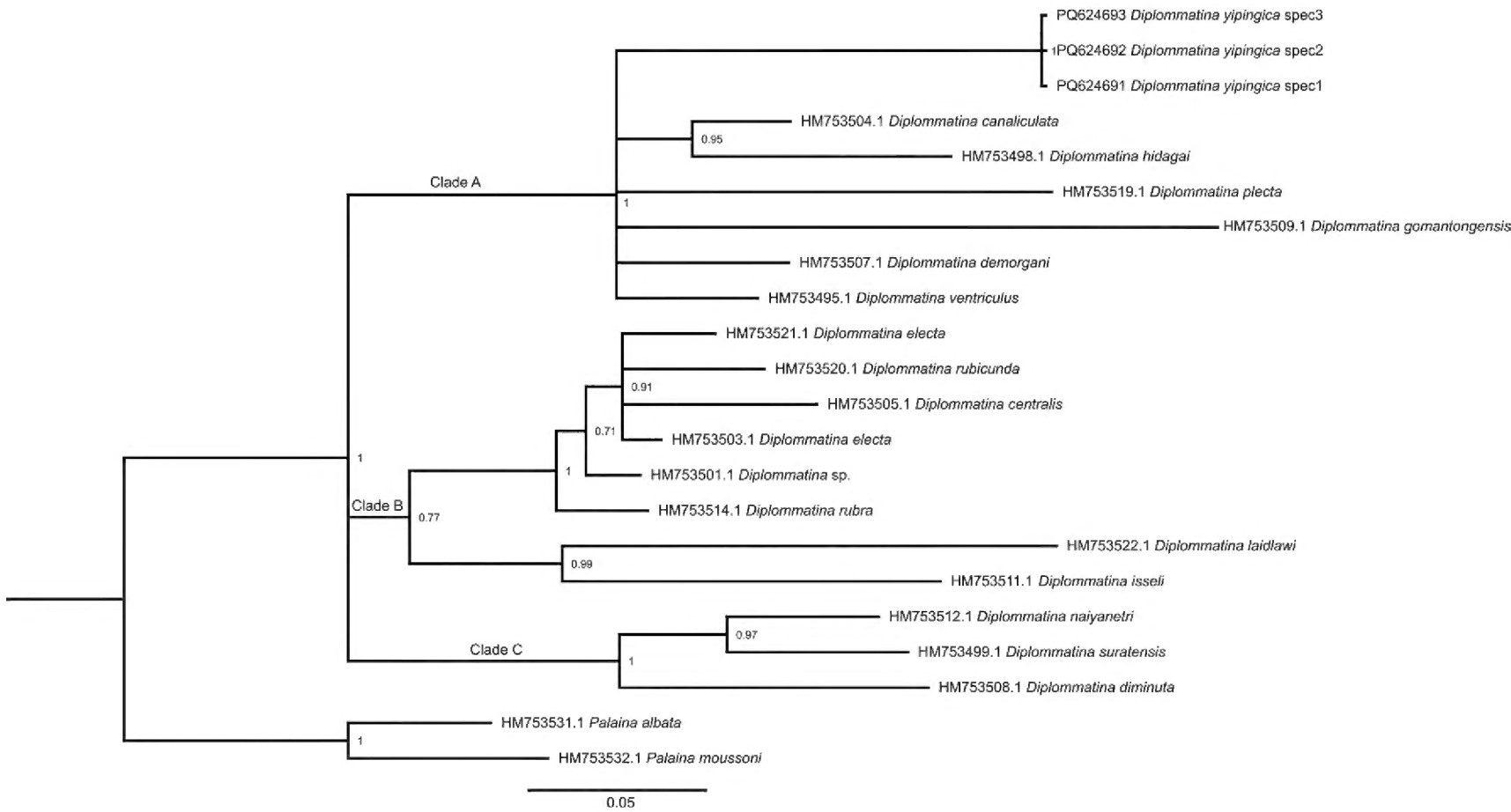


Figure 4. Bayesian Inference tree inferred from 16S gene sequences of *Diplommatina* and related genera.

Taxonomic part

***Diplommatina abbreviata* Heude, 1890**

Diplommatina abbreviata Heude, 1890: 131, pl. 36, fig. 21. – Yen, 1939: 32, pl. 2, fig. 51.

Type material. *Lectotype*, HMT 232a (Figs 5A, 12A), designated herein; six paralectotypes HMT 232b, paralectotype USNM 472301, 5 paralectotypes MCZ 167234.

Type locality. “Tchen-kou, Szechwan” [Chengkou, Chongqing City].

Brief description. Shell dextral, with about 6 whorls. Protoconch smooth. Penultimate whorl slightly expanded, body whorls nearly as wide. Constriction at slight right of parietal wall. No spiral striation visible. Teleoconch with thin, widely-spaced, radial ribs; with ca. 6 ribs per 0.5 mm on penultimate whorl and ca. 5 ribs per 0.5 mm on body whorls. Dorsal fold absent. Umbilicus closed. No double lip. Columellar tooth present. One long horizontal palatalis just above columella. One short vertical palatalis.

Remarks. The lectotype is designated herein in accordance with Art. 74 of the Code (ICZN 1999) for the stabilisation of the name. Johnson (1973) listed ‘paratypes’ housed in USNM and MZC.

***Diplommatina (Sinica) apicina* (Gredler, 1885)**

Moussonia apicina Gredler, 1885: 229–231.

Diplommatina (Sinica) apicina – Kobelt & Möllendorff, 1898: 139; Kobelt, 1902: 455; Zilch, 1953: 25.

Diplommatina apicina – Yen 1939: 31, pl. 2, fig. 40.

Type material. Not seen.

Other material. Eight non-type specimens SMF 39624 (Figs 5B, 12B).

Type locality. “Ta-hung-tung, Thien-heu-san, Kueitschen” [Hunan Province], the current name of the locality cannot be confirmed.

Brief description. Shell dextral. 7 Whorls. Penultimate and body whorls nearly equal in width. Teleoconch with thin, widely spaced, radial ribs; with ca. 7 ribs per 0.5 mm on penultimate whorl and ca. 5 ribs per 0.5 mm on body whorls. Double lip present. Columellar tooth present. One horizontal palatalis above columella. No vertical palatalis visible.

Remarks. Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*. Yen (1939) and Zilch (1953) listed probable syntypes in the SMF; one figured by Yen (1939: pl. 2, fig. 40). However, discrepancies in the collection locality and collector in relation to the original description suggest that these specimens are non-type specimens. Further type specimens are likely kept in the Gredler collection in the Franziskanermuseum Bozen (see Zilch (1974)).

***Diplommatina (Sinica) confusa* Heude, 1885**

Diplommatina confusa Heude, 1885: 97, pl. 24, figs 12, 12a. – Yen, 1948: 75.

Diplommatina (Sinica) confusa – Kobelt & Möllendorff, 1898: 140; Kobelt, 1902: 460.

Type material. *Lectotype* HMT 229a (Figs 5C, 12C), designated herein; 33 paralectotypes HMT 229b, paralectotype USNM 472304, nine paralectotypes MCZ 167034.

Type locality. “Tchen-K’eu” [Chengkou, Chongqing City].

Brief description. Shell dextral, with about 6 whorls. Protoconch smooth. Penultimate whorl slightly expanded, body whorls nearly as wide. Constriction at slightly right of parietal wall. No spiral striation visible. Teleoconch with thin, widely spaced, radial ribs, ca. 7 ribs per 0.5 mm on penultimate whorl, ca. 5 ribs per 0.5 mm on body whorl. Dorsal fold absent. Umbilicus closed. Double lip present. Columellar tooth present. One short horizontal palatalis just above columella. One vertical palatalis.

Remarks. The lectotype is designated herein in accordance with Art. 74 of the Code (ICZN 1999) for the stabilisation of the name. Johnson (1973) listed ‘paratypes’ housed in USNM and MZC. Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*. For HMT specimens, 33 specimens moved to *D. (S.) setchuanensis* by Dr. C.-C. Hwang, one specimen has been separated by Dr. C.-C. Hwang as form A (Figs 5D, 12D), another specimen as form B (Figs 5E, 12E). Both forms alleged to be distinct from *D. confusa*.

***Diplommatina (Sinica) conica* Möllendorff, 1885**

Diplommatina conica Möllendorff, 1885: 163–164. – Yen, 1939: 31, pl. 2, fig. 43.

Diplommatina (Sinica) conica – Kobelt & Möllendorff, 1898: 140; Kobelt, 1902: 460; Zilch, 1953: 28.

Type material. *Lectotype* SMF 39646 (Figs 5F, 12F); six paralectotypes SMF 39647, three paralectotypes SMF 39658.

Type locality. “Patung, Hupei” [Badong, Hubei Province].

Brief description. Shell dextral, with about 7 whorls. Penultimate whorl slightly expanded, body whorl nearly as wide. Constriction at middle of parietal wall. No spiral striation visible. Teleoconch with strong, dense, radial ribs; ca. 7 ribs per 0.5 mm on both penultimate and body whorls. Dorsal fold absent. Umbilicus absent. Double lip present. Columellar tooth present. One short horizontal palatalis just above columella. One vertical palatalis.

Remarks. Yen (1939) designated and figured the lectotype (SMF 39646). Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*.

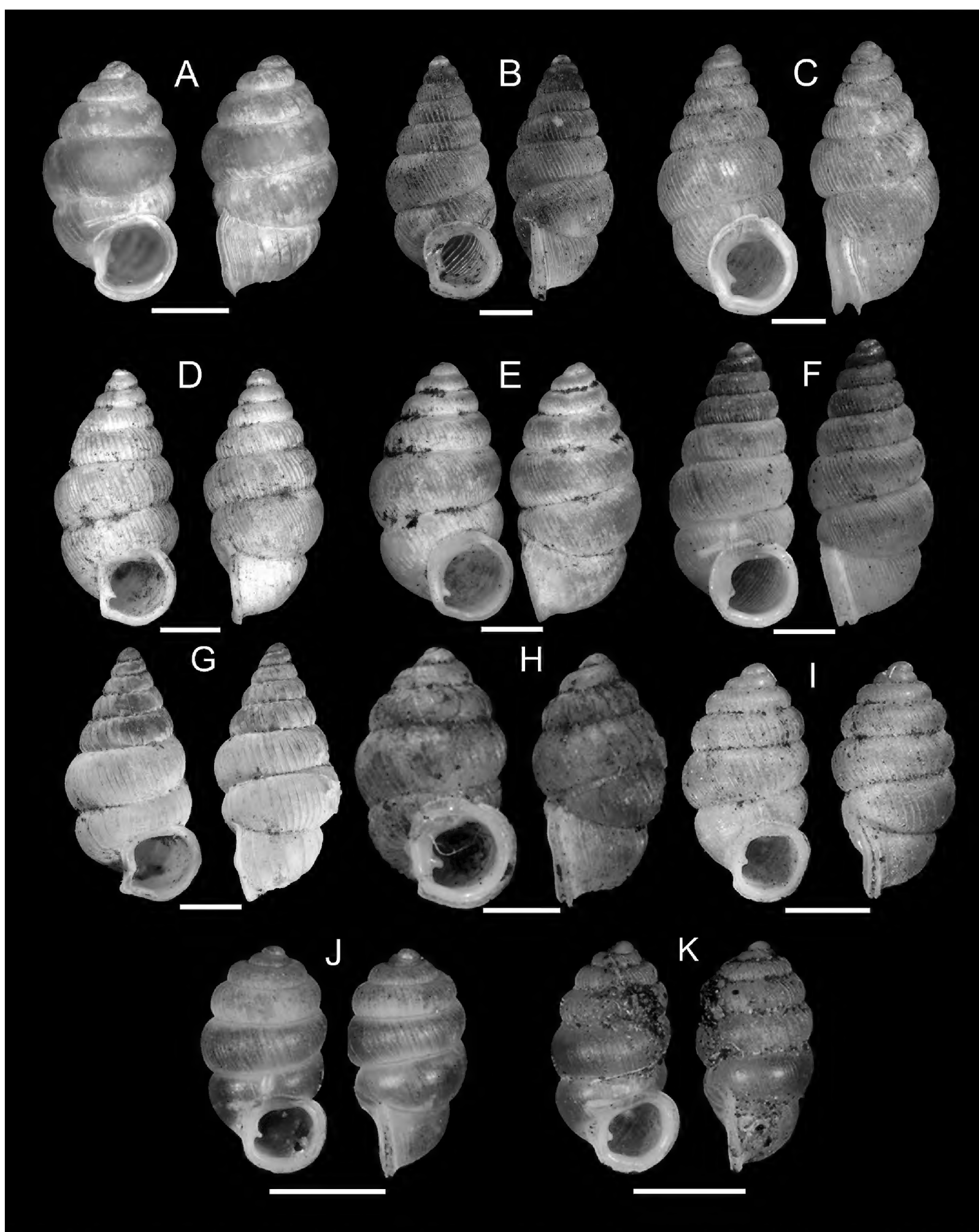


Figure 5. A. Lectotype of *D. (Sinica) abbreviata* HMT 232a; B. Non-type specimen of *D. (Sinica) apicina* SMF 39624; C. Lectotype of *D. (Sinica) confusa* HMT 229a; D. Paralectotype of *D. (Sinica) confusa* HMT 229, non-*confusa* “form A”; E. Paralectotype of *D. (Sinica) confusa* HMT 229, non-*confusa* “form B”; F. Lectotype of *D. conica*, SMF39646; G. Non-type specimen of *D. consularis* SMF 39625; H. *D. (Sinica) contracta*, SMF 39649; I. Paratype of *D. (Sinica) futilis*, SMF 39627; J. *D. (Sinica) hangchowensis* ANSP94748; K. Holotype of *D. hangchowensis granum*, ANSP94747. Scale bar: 1 mm.

***Diplommantina (Sinica) consularis* Gredler, 1886**

Diplommantina consularis Gredler, 1886: 13–15. – Yen, 1939: 31, pl. 2, fig. 41.

Diplommantina (Sinica) consularis – Kobelt & Möllendorff, 1898: 140; Kobelt, 1902: 461; Zilch, 1953: 28.

Type material. 12 syntypes FMB37

Other material. Three non-type specimens SMF 39625 (Figs 5G, 12G).

Type locality. “Peshang, Hunan” [Hunan Province]; the current name of the locality cannot be confirmed.

Brief description. Shell dextral, with about 7 whorls. Penultimate whorl slightly expanded, body whorl nearly as wide. Teleoconch with thin, widely spaced, radial ribs; with ca. 6 ribs per 0.5 mm on penultimate whorl and ca. 5 ribs per 0.5 mm on body whorls. No double lip. Columellar tooth present. One short horizontal palatalis above columella. No vertical palatalis visible.

Remarks. Zilch (1953) listed syntypes in the SMF, one of which was figured earlier by Yen (1939). Nevertheless, discrepancies in the collection locality in relation to the original description suggest that these specimens are

non-type specimens. Further type specimens are likely kept in the Gredler collection in the Franziskanermuseum Bozen (see Zilch (1974)). Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*.

***Diplommatina (Sinica) contracta* Möllendorff, 1886**

Diplommatina contracta Möllendorff, 1886: 173–175. – Yen, 1939: 32, pl. 2, fig. 53.

Diplommatina (Sinica) contracta – Kobelt & Möllendorff, 1898: 140; Kobelt, 1902: 461; Zilch, 1953: 28.

Type material. *Lectotype* SMF 39649 (Figs 5H, 12H); three paralectotypes SMF 39650.

Type locality. “Patung, Hupei” [Badong, Hubei Province].

Brief description. Shell dextral, with about 6 whorls. Penultimate whorl slightly expanded, body whorl nearly as wide. No spiral striation visible. Teleoconch with strong, widely-spaced, radial ribs; ca. 5 ribs per 0.5 mm on penultimate whorl, ca. 3 ribs per 0.5 mm on body whorl. Dorsal fold absent. Umbilicus unknown. Double lip present. Columellar tooth present. No horizontal nor vertical palatalis visible.

Remarks. Yen (1939) designated and depicted the lectotype. Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*.

***Diplommatina (Sinica) cristata* Gredler, 1887**

Diplommatina cristata Gredler, 1887: 367–368.

Diplommatina (Sinica) cristata – Kobelt & Möllendorff, 1898: 140; Kobelt, 1902: 461.

Type material. Five syntypes FMB39.

Type locality. “Hupé” [Hubei Province].

Remarks. Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*. We did not examine the types, hence, no diagnosis is provided.

***Diplommatina (Sinica) futilis* Gredler, 1887**

Diplommatina futilis Gredler, 1887: 368–369. – Yen, 1939: 32, pl. 2, fig. 52.

Diplommatina (Sinica) futilis – Kobelt & Möllendorff, 1898: 140; Kobelt, 1902: 464.

Type material. Four syntypes SMF 39627 (Figs 5I, 12I). 16 syntypes FMB 65.

Type locality. “Hupé” [Hubei Province].

Brief description. Shell dextral, with about 6 whorls. Penultimate whorl slightly expanded; body whorl nearly as wide. No spiral striation visible. Teleoconch with weak, densely-spaced, radial ribs; ca. 8 ribs per 0.5 mm on penultimate whorl. Dorsal fold absent. Umbilicus unknown. Double lip present. Columellar tooth present. One horizontal palatalis above columella. No vertical palatalis visible.

Remarks. Yen (1939) listed four ‘paratypes’ in the SMF and figured one; referred to as ‘cotypes’ by Zilch

(1953). Sixteen type specimens are kept in the Gredler collection in the Franziskanermuseum Bozen (see Zilch (1974)). Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*.

***Diplommatina hangchowensis hangchowensis* Pilsbry & Hirase, 1908**

Diplommatina hangchowensis Pilsbry & Hirase, 1908: 37–38, fig. 1.

Type material. *Lectotype* ANSP 94748 (Figs 5J, 12J), 1 paralectotype ANSP 360072.

Type locality. “Hangchow, Che-kiang” [Hangzhou City, Zhejiang Province].

Brief description. Shell dextral, with about 6 whorls. Penultimate whorl slightly expanded; body whorl nearly as wide. Constriction at the middle of the parietal wall. Teleoconch with weak, widely-spaced, radial ribs; ca. 7–9 ribs per 0.5 mm on penultimate whorl. Dorsal fold absent. Umbilicus unknown. Double lip present. Columellar tooth present. One horizontal palatalis just above the columella. One vertical palatalis.

Remarks. The lectotype was designated by Baker (1964: 164) by reference to a single type specimen (Art. 74.5 of the Code). We treat *Diplommatina hangchowensis granum* as the junior synonym.

***Diplommatina hangchowensis granum* Pilsbry & Hirase, 1908**

Diplommatina hangchowensis granum Pilsbry & Hirase, 1908: 37–38

Type material. *Lectotype* ANSP 94747 (Figs 5K, 12K).

Type locality. “Hangchow” [Hangzhou City, Zhejiang Province].

Remarks. The lectotype was designated by Baker (1964: 164) by reference to a single type specimen (Art. 74.5 of the Code). This taxon is a junior homonym of *Diplommatina granum* Bavay & Dautzenberg, 1904 and, therefore, permanently invalid. We consider it to be a junior synonym of *D. hangchowensis* described from the same type locality. Therefore, we refrain from introducing a replacement name.

***Diplommatina (Sinica) inermis* Gredler, 1887**

Diplommatina inermis Gredler, 1887: 336.

Diplommatina (Sinica) inermis – Kobelt & Möllendorff, 1898: 140; Kobelt, 1902: 465.

Type material. Five syntypes FMB 92.

Type locality. “Pa-tong” [Badong, Hubei Province].

Remarks. The type collection of Gredler is in the Franziskanermuseum in Bozen (Zilch 1974). Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*. We did not examine the types, hence, no diagnosis is provided.

***Diplommatina intermedia* Heude, 1890**

Diplommatina intermedia Heude, 1890: 131, pl. 36, fig. 22.

Type material. *Lectotype* HMT 233a (Figs 6A, 12L), designated herein; 11 paralectotypes HMT 233b; two paralectotypes MCZ 167031.

Type locality. “Tchen-kou, Szechwan” [Chengkou, Chongqing City].

Brief description. Shell dextral, with about 6 whorls. Protoconch smooth. Penultimate whorl slightly expanded; body whorl nearly as wide. Constriction at slightly left of parietal wall. No spiral striation visible. Teleoconch with thin, dense, radial ribs; ca. 6 ribs per 0.5 mm on penultimate whorl, ca. 4 ribs per 0.5 mm on body whorl. Dorsal fold absent. Umbilicus open, shallow. Double lip present. Columellar tooth present. One short horizontal palatalis above columella. One vertical palatalis.

Remarks. The lectotype is designated herein in accordance with Art. 74 of the Code (ICZN 1999) for the stabilisation of the name. *Diplommatina intermedia* Nicolas, 1891 and *D. balansai* var. *intermedia* Bavay & Dautzenberg, 1904 are both junior homonyms.

***Diplommatina liboensis* Ran, Chen & Zhang, 1999**

Diplommatina liboensis Ran, Chen & Zhang, 1999: 281, fig. 1.

Type material. *Holotype* IZCAS TM136833 (Figs 6B, 12M), 72 paratypes IZCAS TM101985-102056.

Other material. Non-type specimens IZCAS TM136834-136926.

Type locality. Libo County, Guizhou Province.

Brief description. Shell dextral, with about 7.5 whorls. Protoconch smooth. Penultimate whorl slightly expanded; body whorl nearly as wide. Teleoconch with thin, dense, radial ribs; ca. 5 ribs per 0.5 mm on penultimate whorl, ca. 4 ribs per 0.5 mm on body whorl. Double lip present. Columellar tooth absent. No horizontal palatalis nor vertical palatalis visible.

Remarks. The specimens TM136834-136926, the date of collection and the number of specimens, inconsistent with the original description, are confirmed as non-type specimens.

***Diplommatina longxianensis* Chen, Liu, Xu & Yan, 1994**

Diplommatina longxianensis Chen, Liu, Xu & Yan, 1994:44, fig. 1.

Type material. *Holotype* IZCAS TM010064 (Figs 6C, 12N), 29 paratypes IZCASTM010065-010093.

Type locality. Longxian County, Shaanxi Province.

Brief description. Shell dextral, with about 6.5 whorls. Protoconch smooth. Penultimate whorl slightly expanded; body whorl nearly as wide. Teleoconch with thin, dense, radial ribs; ca. 7 ribs per 0.5 mm on penultimate whorl, ca. 6 ribs per 0.5 mm on body whorl. No double

lip. Columellar tooth present. No horizontal palatalis nor vertical palatalis visible.

Remarks. The original literature mentions 26 paratypes (Chen et al. 1994). Nonetheless, 29 specimens were deposited together that correspond to the collection's locality and time mentioned in literature, indicating that the correct number of paratypes should be 29 (ICZN Art 72.4.1).

***Diplommatina mangshanensis* Hu, Yin & Chen, 2003**

Diplommatina mangshanensis Hu, Yin & Chen, 2003: 232–234, figs 1, 2.

Type material. *Holotype* IZCAS CT-001 (Figs 6D, 12O), two paratypes CT-002, five paratypes CT-003.

Type locality. Mangshan, Hunan Province.

Brief description. Shell dextral, with about 5.5 whorls. Protoconch smooth. Penultimate whorl slightly expanded, body whorls nearly as wide. Teleoconch with thin, widely spaced, radial ribs; with ca. 8 ribs per 0.5 mm on penultimate whorl and ca. 7 ribs per 0.5 mm on body whorls. Double lip present. Columellar tooth present. One long horizontal palatalis just above columella. One short vertical palatalis.

Remarks. Five paratypes (CT-003) are juveniles.

***Diplommatina minuscula* Heude, 1890**

Diplommatina minuscula Heude, 1890: 131, pl. 36, fig. 20.

Type material. *Lectotype*, HMT 234a (Figs 6E 12P), designated herein; two paralectotypes HMT 234b, two paralectotypes MCZ 167032.

Type locality. “Tchen-kou, Szechwan” [Chengkou, Chongqing City].

Brief description. Shell dextral, with about 6–6.5 whorls. Protoconch smooth. Penultimate whorl slightly expanded; body whorl nearly equal in width. Constriction at middle of parietal wall. No spiral striation visible. Teleoconch with strong, widely-spaced, radial ribs; ca. 6–8 ribs per 0.5 mm on both penultimate and body whorls. Dorsal fold absent. Umbilicus closed. Double lip present. Columellar tooth present. One short horizontal palatalis just above columella. One short vertical palatalis.

Remarks. The lectotype is designated herein in accordance with Art. 74 of the Code (ICZN 1999) for the stabilisation of the name. Johnson listed ‘paratypes’ housed in the MCZ. *Diplommatina minuscula* Chen & Zhang, 1998 is a junior homonym and, therefore, the name is permanently invalid. A replacement name *Diplommatina yunnanensis* is proposed below (ICZN Art 34.2).

***Diplommatina (Sinica) paxillus paxillus* (Gredler, 1881)**

Moussonia paxillus Gredler, 1881: 29–31, pl. 1, fig. 7.

Diplommatina (Sinica) paxillus – Schmacker & Boettger, 1890: 121;

Kobelt & Möllendorff, 1898: 141; Kobelt, 1902: 469; Zilch, 1953: 34.

Diplommatina paxillus paxillus – Yen, 1939: 31, pl. 2, fig. 46.

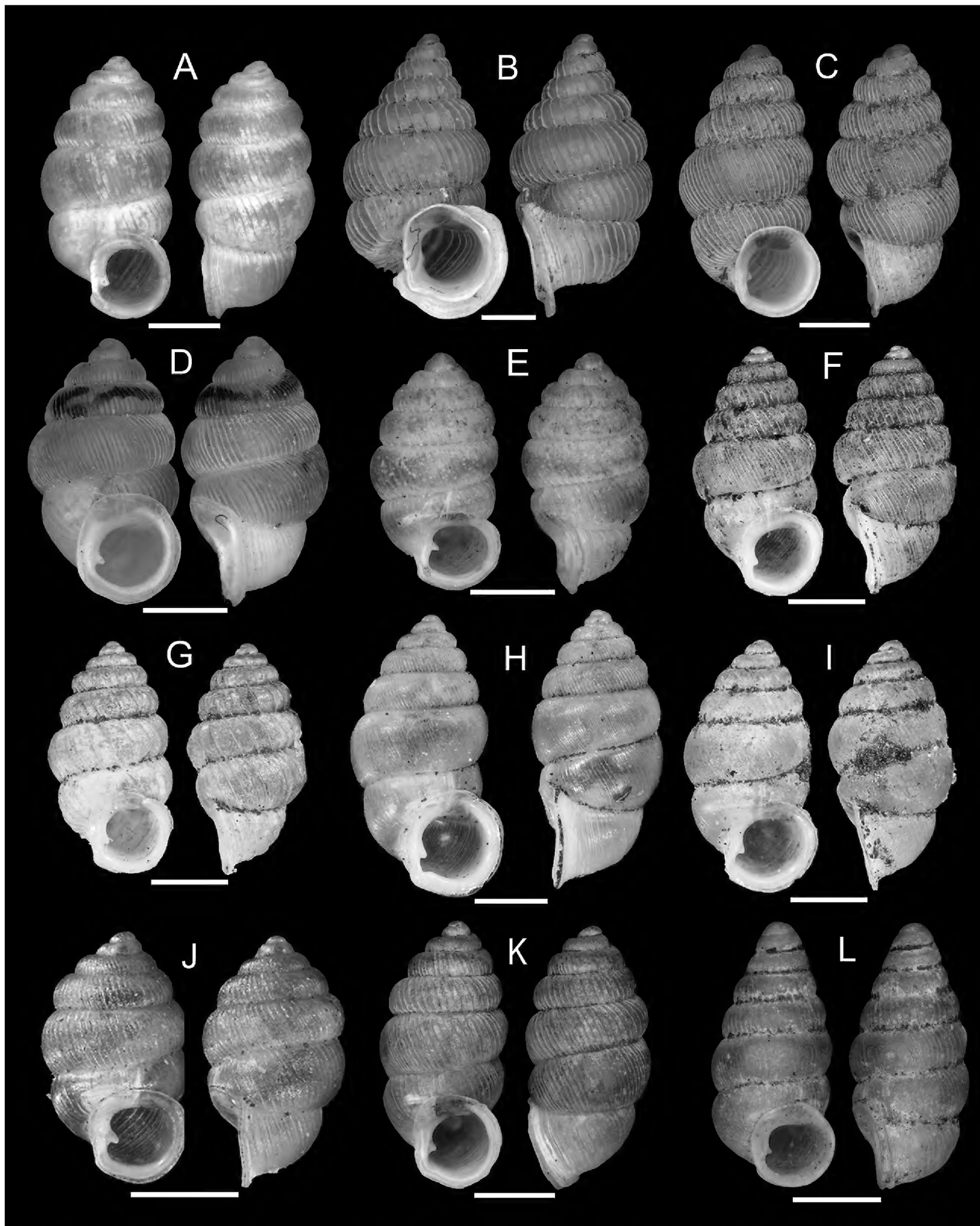


Figure 6. A. Lectotype of *D. (Sinica) intermedia* HMT 233a; B. Holotype of *D. liboensis* IZCAS TM136833; C. Holotype of *D. longxianensis* IZCAS TM010064; D. Holotype of *D. mangshanensis* IZCAS CT-001; E. Lectotype of *D. (Sinica) minuscula* HMT 234a; F. Paratype of *D. paxillus*, SMF39629; G. Paratype of *D. paxillus hunanensis*, SMF39641; H. Lectotype of *D. paxillus robusta* SMF39642; I. Lectotype of *D. paxillus longipalatalis*, SMF39639; J. Lectotype of *D. mucronata*, SMF39662; K. Paratype of *D. (Sinica) pupinella*, HMT 231a; L. Lectotype of *D. (Sinica) pyra* HMT 230a. Scale bar: 1 mm.

Type material. Seven syntypes SMF 39629 (Figs 6F, 12Q). Two syntypes FMB 142.

Type locality. “Yün-tscheu-fu” [Hunan Province]; the current name of the locality cannot be confirmed.

Brief description. Shell dextral, with about 7 whorls. Protoconch smooth. Penultimate whorl wider than body whorl. Constriction at middle of parietal wall. Teleoconch with weak, dense, radial ribs; ca. 10 ribs per 0.5 mm on penultimate whorl, ca. 7 ribs per 0.5 mm on body whorl.

Dorsal fold absent. Umbilicus unknown. Double lip present. Columellar tooth present. One strong horizontal palatalis just above columella. One short vertical palatalis.

Remarks. Yen (1939) listed ‘paratypes’ in the SMF and figured one; referred to as ‘cotypes’ by Zilch (1953). Two type specimens are kept in the Gredler collection in the Franziskanermuseum Bozen (see Zilch (1974)). Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*.

***Diplommatina (Sinica) paxillus hunanensis* Zilch, 1953**

Diplommatina paxillus var. *latecostata* Gredler, 1887: 157.

Diplommatina (Sinica) paxillus var. *latecostata* – Kobelt & Möllendorff, 1898: 141; Kobelt, 1902: 469.

Diplommatina paxillus latecostata – Yen, 1939: 32, pl. 2, fig. 49.

Diplommatina (Sinica) paxillus hunanensis Zilch, 1953: 34.

Type material. Seven syntypes SMF 39641 (Figs 6G, 12R).

Type locality. “Hunan” [Hunan Province].

Brief description. Shell dextral, with about 6 whorls. Protoconch smooth. Penultimate whorl wider than body whorl. Constriction at middle of parietal wall. Teleoconch with strong, widely spaced, radial ribs; about 3 ribs per 0.5 mm on both penultimate and body whorl. Dorsal fold absent. Umbilicus unknown. Double lip present. Columellar tooth present. One vertical palatalis. No horizontal visible.

Remarks. Yen (1939) listed and figured one ‘paratype’ in the SMF. Zilch (1953) listed seven ‘cotypes’. Further type specimens are likely kept in the Gredler collection in the Franziskanermuseum Bozen (see Zilch (1974)). The original name is an objective junior synonym of *Diplommatina latecostata* Mousson, 1870 and, therefore, permanently invalid. Zilch (1953) introduced *Diplommatina paxillus* var. *hunanensis* as a replacement name.

***Diplommatina (Sinica) paxillus lissa* (Gredler, 1884)**

Moussonina paxillus var. *lissa* Gredler, 1884: 260.

Diplommatina paxillus var. *lissa* – Gredler, 1887: 157.

Diplommatina (Sinica) paxillus var. *lissa* – Kobelt & Möllendorff, 1898: 141; Kobelt, 1902: 470.

Diplommatina paxillus lissa – Yen, 1939: 31, pl. 2, fig. 47.

Type material. Four syntypes FMB 110.

Type locality. “Shang-in Hisen” [Southern than Hengzhou Fu, Hunan Province].

Brief description. Shell dextral. Protoconch smooth, about 7 whorls. Penultimate whorl wider than the body whorl. Constriction at the centre-right of the parietal wall. Teleoconch with weak, dense, radial ribs. Dorsal fold absent. Umbilicus unknown. Double lips present. Columellar tooth presents. One nipple-formed tooth at the bottom of peristome. One horizontal palatalis just above the columella. No vertical palatalis visible.

Remarks. Yen (1939) listed several non-type lots housed in the SMF. *Diplommatina paxillus* var. *robusta* is a junior synonym (Yen 1939; Zilch 1953).

***Diplommatina (Sinica) paxillus robusta* Möllendorff, 1886**

Diplommatina paxillus var. *robusta* Möllendorff, 1886: 174.

Type material. **Lectotype** SMF 39642 (Figs 6H, 12S); six paralectotypes SMF 39643 (from “Heng-shan-hsian and Heng-dshou-fu”).

Typelocality. “Shang-in-shien, Hunan” [Hunan Province].

Remarks. Yen (1939) designated the lectotype and synonymised *D. paxillus* var. *robusta* with *D. paxillus* var. *lissa*. This treatment was followed by Zilch (1953) and is maintained herein.

***Diplommatina (Sinica) paxillus longipalatalis* Schmacker & Boettger, 1890**

Diplommatina (Sinica) paxillus var. *longipalatalis* Schmacker & Boettger, 1890: 123. – Kobelt & Möllendorff, 1898: 141; Kobelt, 1902: 470; Zilch, 1953: 34.

Diplommatina paxillus longipalatalis – Yen, 1939: 32, pl. 2, fig. 48.

Type material. **Lectotype** SMF 39639 (Figs 6I, 12T); 4 paralectotypes SMF 39640.

Type locality. “Lüshan-Gebirge bei Kiukiang” [Lushan, Jiujiang City, Jiangxi Province].

Brief description. Shell dextral, with about 7 whorls. Protoconch smooth. Penultimate whorl wider than body whorl. Constriction at middle of parietal wall. Teleoconch with weak, dense, radial ribs. Dorsal fold absent. Umbilicus unknown. Double lip present. Columellar tooth present. One long, strong horizontal palatalis above columella. One short vertical palatalis.

Remarks. Yen (1939) designated and figured the lectotype.

***Diplommatina (Sinica) paxillus mucronata* Schmacker & Boettger, 1890**

Diplommatina (Sinica) paxillus var. *mucronata* Schmacker & Boettger, 1890: 122. – Kobelt & Möllendorff, 1898: 141; Kobelt, 1902: 470; Zilch, 1953: 35.

Diplommatina paxillus mucronata – Yen, 1939: 32, pl. 2, fig. 50.

Type material. **Lectotype** SMF 39662 (Figs 6J, 12U); two paralectotypes SMF 39663.

Type locality. “Dalanshan-Gebirge bei Ningpo” [Dalanshan, Ningbo City].

Brief description. Shell dextral, with about 6 whorls. Protoconch smooth. Penultimate whorl wider than body whorl. Constriction at right of parietal wall. Teleoconch with weak, dense, radial ribs; ca. 8 ribs per 0.5 mm on penultimate whorl. Dorsal fold absent. Umbilicus unknown. Double lip absent. Columellar tooth present. One long, strong horizontal palatalis just above columella. One vertical palatalis.

Remarks. Yen (1939) designated and figured the lectotype.

***Diplommatina (Sinica) pupinella* Heude, 1885**

Diplommatina pupinella Heude, 1885: 97, pl. 24, fig. 13.

Diplommatina (Sinica) pupinella – Kobelt & Möllendorff, 1898: 141; Kobelt, 1902: 470.

Type material. Lectotype, HMT 231a (Figs 6K, 12V), designated herein; seven paralectotypes HMT 231b, paralectotype USNM 472300, four paralectotypes MCZ 167030.

Type locality. “Tchen-k’eu” [Chengkou, Chongqing City].

Brief description. Shell dextral, with about 7 whorls. Protoconch smooth. Penultimate slightly expanded; body whorl nearly as wide. Constriction at slightly left of parietal wall. No spiral striation visible. Teleoconch with strong, dense, radial ribs; ca. 7 ribs per 0.5 mm on both penultimate and body whorls. Dorsal fold absent. Umbilicus open, shallow. Double lip present. Columellar tooth present. One short horizontal palatalis just above columella. One vertical palatalis.

Remarks. The lectotype is designated herein in accordance with Art. 74 of the Code (ICZN 1999) for the stabilisation of the name. Johnson (1973) listed ‘paratypes’ in USNM and MCZ. Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*.

Diplommatina (Sinica) pyra Heude, 1885

Diplommatina pyra Heude, 1885: 98, pl. 24, fig. 14.

Diplommatina (Sinica) pyra – Kobelt & Möllendorff, 1898: 141; Kobelt, 1902: 471.

Type material. Lectotype, HMT 230a (Figs 6L, 12W), designated herein; paralectotype MCZ 167219.

Type locality. “Tchen Keou tin” [Chengkou, Chongqing City].

Brief description. Shell dextral, with about 7 whorls. Protoconch smooth. Penultimate slightly expanded; body whorl nearly as wide. Constriction at middle of parietal wall. No spiral striation visible. Teleoconch with strong, dense, radial ribs; ca. 7 ribs per 0.5 mm on penultimate whorl, ca. 8 ribs per 0.5 mm on body whorl. Dorsal fold absent. Umbilicus open, shallow. Double lip present. Columellar tooth absent. One short horizontal palatalis just above columella. No vertical palatalis visible.

Remarks. The lectotype is designated herein in accordance with Art. 74 of the Code (ICZN 1999) for the stabilisation of the name. Johnson (1973) listed one ‘paratype’ in the MCZ. Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*.

Diplommatina qinghensis Chen, Zhang & Wang, 2002

Diplommatina qinghensis Chen, Zhang & Wang, 2002: 221–224, figs 3, 4.

Type material. *Holotype* IZCAS CT-014 (Figs 7A, 13A), four paratypes IZCAS CT-015, nine paratypes IZCAS CT-016.

Type locality. Kangxian, Longnan City, Gansu Province.

Brief description. Shell dextral, with about 5.5 whorls. Protoconch smooth. Penultimate whorl slightly expanded; body whorl nearly as wide. Teleoconch with

thin, dense, radial ribs; ca. 10 ribs per 0.5 mm on penultimate whorl, ca. 8 ribs per 0.5 mm on body whorl. No double lip. Columellar tooth absent. No horizontal palatalis nor vertical palatalis visible.

Remarks. The holotype corresponds to the figure in the original description; however, the shell size is larger than that described in the original literature.

Diplommatina (Sinica) rufa Möllendorff, 1882

Diplommatina rufa Möllendorff, 1882: 350, pl. 10, fig. 8. – Yen, 1939: 32, pl. 2, fig. 54.

Diplommatina (Sinica) rufa Kobelt & Möllendorff, 1898: 141; Kobelt, 1902: 471; Zilch, 1953: 35.

Type material. *Lectotype* SMF 39665 (Figs 7B, 13B); four paralectotypes SMF 39666, three paralectotypes SMF 39667.

Type locality. “Lo-fou-shan, Kwangtung” [Luofushan, Huizhou City, Guangdong Province].

Brief description. Shell dextral, with about 5 whorls. Protoconch smooth. Penultimate whorl slightly wider than body whorl. Constriction at slightly right of parietal wall. Teleoconch smooth. Dorsal fold absent. Umbilicus unknown. Double lip present. Columellar tooth present. One horizontal palatalis just above columella. One vertical palatalis.

Remarks. Yen (1939) designated and depicted the lectotype. Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*.

Diplommatina schmackeriana Yen, 1939

Diplommatina schmackeriana Yen, 1939: 33, pl. 2, fig. 55.

Type material. *Lectotype* SMF 40281 (Figs 7C, 13C); two paratypes SMF 40282, paratype SMF 40283.

Type locality. “Mirsbay, Kwangtung” [Dapengwan, Hong Kong].

Brief description. Shell dextral, with about 6 whorls. Protoconch smooth. Penultimate whorl slightly wider than body whorl. Constriction at slightly left of parietal wall. Penultimate whorl and body whorl smooth. Dorsal fold absent. Umbilicus unknown. Double lip present. Columellar tooth present. One strong horizontal palatalis just above columella. One short vertical palatalis.

Remarks. The holotype has been figured by Yen (1939).

Diplommatina (Sinica) sculptilis Möllendorff, 1885

Diplommatina sculptilis Möllendorff, 1885: 368–370, pl. 9, fig. 5. – Yen, 1939: 31, pl. 2, fig. 44.

Diplommatina (Sinica) sculptilis – Kobelt & Möllendorff, 1898: 141; Kobelt, 1902: 472; Zilch, 1953: 36.

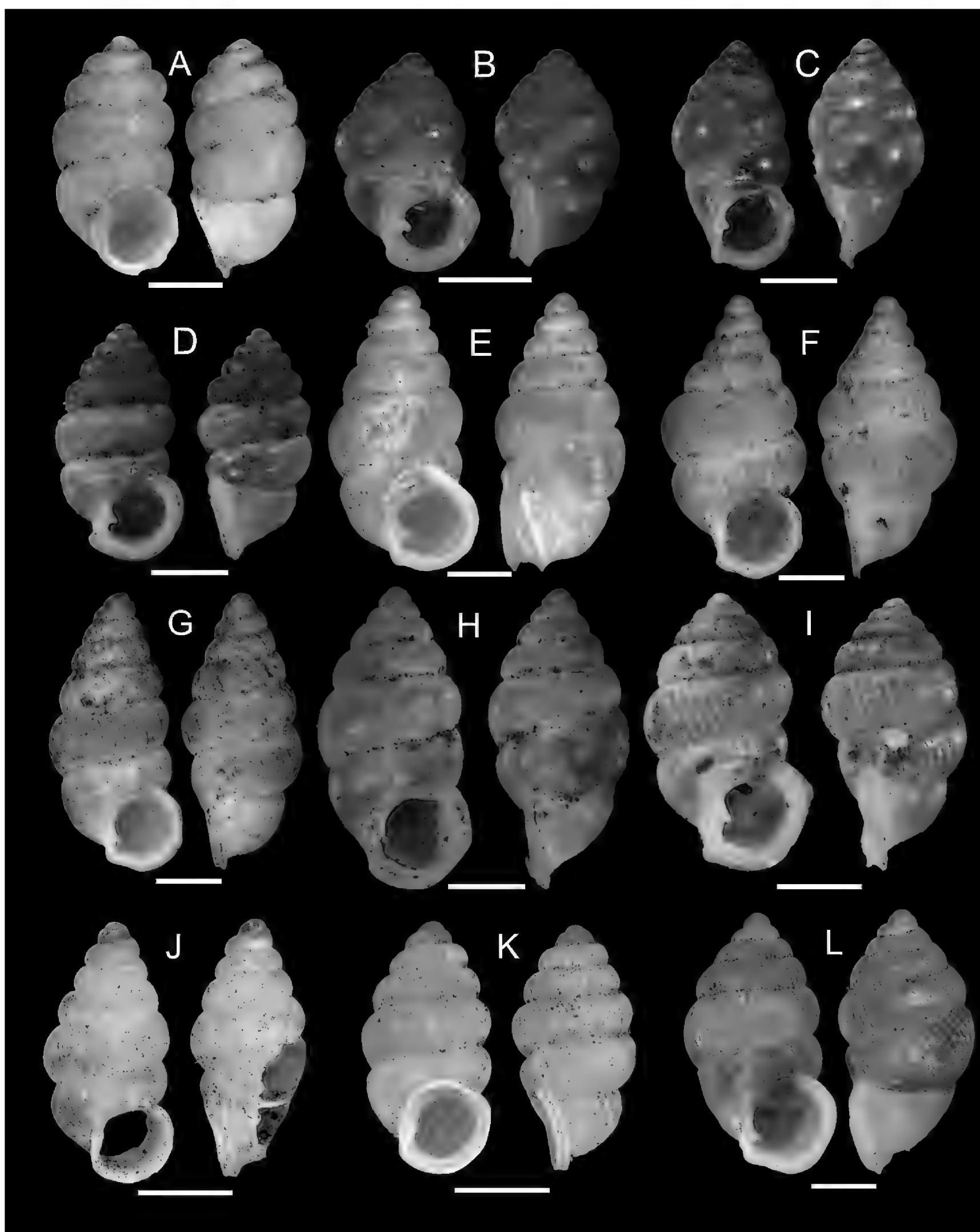


Figure 7. **A.** Holotype of *D. qinghensis* IZCAS CT-014; **B.** Lectotype of *D. rufa*, SMF39665; **C.** Holotype of *D. schmackeriana*, SMF40281; **D.** Lectotype of *D. (Sinica) sculptilis*, SMF 39655; **E.** Lectotype of *D. (Sinica) setchuanensis* HMT 228a; **F.** Paralectotype of *D. (Sinica) setchuanensis* HMT 228, non-*setchuanensis* form A; **G.** Paralectotype of *D. (Sinica) setchuanensis* HMT 228, non-*setchuanensis* form B; **H.** Holotype of *D. subcylindrica*, SMF39661; **I.** Holotype of *D. triangulata*, SMF39672; **J.** Holotype of *D. xiazayuensis* IZCAS TM1010000; **K.** Paratypes of *D. xiazayuensis* IZCAS TM010045 ; **L.** Holotype of *D. xingyinensis* IZCAS CT-022. Scale bar: 1 mm.

Type material. *Lectotype* SMF 39655 (Figs 7D, 13D); paralectotypes SMF 39656-39660, paralectotype ANSP 212197.

Type locality. “Shiu-hing, Guang-dung” [Zhaoqing City, Guangdong Province].

Brief description. Shell dextral, with about 7 whorls. Protoconch smooth. Penultimate whorl slightly

wider than body whorl. Constriction at middle of parietal wall. Teleoconch with weak, dense, radial ribs; ca. 6 ribs per 0.5 mm on both penultimate and body whorls. Dorsal fold absent. Umbilicus unknown. Double lip present. Columellar tooth present. One strong horizontal palatalis just above columella. One short vertical palatalis.

Remarks. Yen (1939) designated and figured the lectotype. Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*.

Diplommatina (Sinica) setchuanensis Heude, 1885

Diplommatina setchuanensis Heude, 1885: 97, pl. 24, figs 10 and 10a-b.
Diplommatina (Sinica) setchuanensis – Kobelt & Möllendorff, 1898: 141; Kobelt, 1902: 471.

Type material. *Lectotype* HMT 228a (Figs 7E, 13E), designated herein; five paralectotypes HMT 228b, lot “A”, 4 paralectotypes (see Remarks below) (Figs 7F, 13F), lot “B”, 16 paralectotypes (see Remarks below) (Figs 7G, 13G); paralectotype USNM 472302, five paralectotypes MCZ 167226.

Typelocality. “Tchen-k’eu” [Chenkou, Chongqing City].

Brief description. Shell dextral, with about 7 whorls. Protoconch smooth. Penultimate whorl slightly expanded; body whorl nearly as wide. Constriction at slightly right of parietal wall. No spiral striation visible. Teleoconch with strong, dense, radial ribs; ca. 6 ribs per 0.5 mm on penultimate whorl, ca. 7 ribs per 0.5 mm on body whorl. Dorsal fold absent. Umbilicus closed. Double lip present. Columellar tooth present. No horizontal palatalis nor vertical palatalis visible.

Remarks. The lectotype is designated herein in accordance with Art. 74 of the Code (ICZN 1999) for the stabilisation of the name. Johnson listed ‘paratypes’ in USNM and MCZ. C.-C. Hwang studied the type series and separated two specimen lots A and B (see above) as representing different species.

Diplommatina szechuanensis Pilsbry, 1934

Diplommatina szechuanensis Pilsbry, 1934: 25, pl. 6, figs 1 and 1a.

Type material. *Holotype* ANSP 159705, paratypes ANSP 464794.

Typelocality. “Chengwai, Szechwan” [Sichuan Province].

Brief description. Shell dextral, with about 7 whorls. Protoconch smooth. Teleoconch with strong, dense, radial ribs, apart on the front of the penult whorl, 6 ribs per 0.5 mm on body whorl. The last whorl consists of a slightly oblique palatal rib at the constriction, a rather strong parietal lamella and the inward continuation of the columellar lamella.

Remarks. The holotype was originally designated by Pilsbry (1934) in the legend of plate 6 (p. 28). The types have been listed in the catalogue of Baker (1964: 165).

Diplommatina (Sinica) subcylindrica Möllendorff, 1882

Diplommatina subcylindrica Möllendorff, 1882: 349–350. – Yen, 1939: 31, pl. 2, fig. 42.

Diplommatina (Sinica) subcylindrica – Kobelt & Möllendorff, 1898: 142; Kobelt, 1902: 473; Zilch, 1953: 36.

Type material. *Lectotype* SMF 39661 (Figs 7H, 13H), designated by Yen (1939).

Type locality. Yang-hu, Fudshien. The current name of the locality cannot be confirmed.

Brief description. Shell dextral, with about 7 whorls. Protoconch smooth. Penultimate whorl slightly wider than body whorl. Constriction at middle of parietal wall. Teleoconch with weak, dense, radial ribs. Dorsal fold absent. Umbilicus unknown. Double lip present. Columellar tooth weak. One strong horizontal palatalis just above columella. One short vertical palatalis.

Remarks. A single type specimen is known to exist. It has been referred to as the holotype and was figured by Yen (1939). However, the original description does not contain a type designation nor does it specify the number of specimens on which it is based. Therefore, Yen’s (1939) reference to the holotype is herein considered to constitute a lectotype designation in accordance with Art. 74.6 of the Code (ICZN 1999). Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*.

Diplommatina (Sinica) tantilla (Gould, 1859)

Paxillus tantillus Gould, 1859: 138.

Diplommatina (Sinica) tantilla – Kobelt & Möllendorff, 1898: 142; Kobelt, 1902: 475.

Diplommatina tantilla – Yen, 1939: 33, pl. 2, fig. 57.

Type material. Whereabouts unknown.

Type locality. Hong-Kong [China].

Remarks. Kobelt and Möllendorff (1898) assigned this species to the subgenus *Sinica*. Yen (1939) listed and figured non-type material in the SMF. We did not examine the types; hence, no diagnosis is provided.

Diplommatina triangulata Yen, 1939

Diplommatina triangulata Yen, 1939: 33, pl. 2, fig. 56.

Type material. *Holotype* SMF 39672 (Figs 7I, 13I).

Type locality. “Mang-hao, Yünnan” [Manghao, Yunnan Province].

Brief description. Shell dextral, with about 7 whorls. Protoconch smooth. Penultimate whorl expanded. Constriction at slightly right of parietal wall. Teleoconch with strong, widely-spaced, radial ribs; ca. 4 ribs per 0.5 mm on both penultimate and body whorls. Dorsal fold absent. Umbilicus unknown. Double lip present. Columellar tooth present. One strong horizontal palatalis just above columella. One short vertical palatalis.

Remarks. The holotype was figured by Yen (1939).

***Diplommatina (Sinica) xiazayuensis* Chen & Guo, 2001**

Diplommatina xiazayuensis Chen & Guo, 2001: 166–169, figs 4, 5.

Type locality. Zayu, Xizang Autonomous Region.

Type material. *Holotype* IZCAS TM1010000 (Figs 7J, 13J), 53 paratypes IZCAS TM010001–010053.

Brief description. Shell dextral, with about 6.5 whorls. Protoconch smooth. Penultimate whorl slightly expanded, body whorls nearly as wide. Teleoconch with thin, widely spaced, radial ribs; with ca. 8 ribs per 0.5 mm on penultimate whorl and ca. 7 ribs per 0.5 mm on body whorls. Double lip present. Columellar tooth present. No horizontal palatalis nor vertical palatalis visible.

Remarks. The holotype is broken; therefore, the paratype IZCAS TM010045 (Fig. 7K) was also photographed. In the original literature, there are a total of 37 paratypes. However, 53 specimens match the collection locality and time in the literature and were deposited together, suggesting that the paratypes should be 53. (ICZN Art 72.4.1).

***Diplommatina xingyinensis* Zhou, Chen & Li, 2005**

Diplommatina xingyinensis Zhou, Chen & Li, 2005: 725–727, figs 1–4.

Type material. *Holotype* IZCAS CT-022 (Figs 7L, 13K), 31 paratypes IZCAS CT-019, six paratypes IZCAS CT-020, 13 paratypes IZCAS CT-021, one paratype IZCAS CT-019a.

Type locality. Xingyi City, Guizhou Province.

Brief description. Shell dextral, with about 6.5 whorls. Protoconch smooth. Penultimate whorl slightly expanded, body whorls nearly as wide. Teleoconch with thin, widely-spaced, radial ribs; with ca. 7 ribs per 0.5 mm on penultimate whorl and ca. 6 ribs per 0.5 mm on body whorls. Double lip present. Columellar tooth present. No horizontal palatalis nor vertical palatalis visible.

Remarks. The holotype was originally designated by Zhou, Chen & Li.

***Diplommatina yunnanensis* Zhang, Xie & Köhler, nom. nov.**

Diplommatina minuscula Chen & Zhang, 1998: Vol 23, No 4, 347, fig. 2

Diplommatina yunnanensis Zhang, Xie & Köhler, nom. nov.

Type material. *Holotype* IZCAS TM009566 (Figs 8A, 13L), 24 paratypes IZCAS TM009547–009570, one paratype IZCAS 156036, one paratype IZCAS 155985, 138 paratypes IZCAS TM048307–048444.

Type locality. Mengla County, Yunnan

Brief description. Shell dextral, with about 7.5 whorls. Protoconch smooth. Penultimate whorl slightly expanded, body whorls nearly as wide. Teleoconch with strong, widely spaced, radial ribs; with ca. 6 ribs per

0.5 mm on penultimate whorl and ca. 5 ribs per 0.5 mm on body whorls. Double lip present. Columellar tooth absent. No horizontal palatalis nor vertical palatalis visible.

Remarks. The original spelling of the species name “*minusculus*” is incorrect. The name is an adjective and needs to be in the same gender as the genus name (ICZN Art 31.2). The correct name is ‘*minuscula*’, which renders this taxon a junior homonym of *D. minuscula* Heude, 1890. Here, *D. yunnanensis* is introduced as a replacement name in accordance with Art 34.2 of the Code (ICZN 1999). The type material has been deposited with the NCMZ (Chen and Zhang 1998). The type locality is Xishaungbanna in Yunnan Province. In the original literature, there are a total of 138 paratypes. However, 164 specimens were deposited together and the collection locality and time in the literature were matched, suggesting that the paratypes should total 164 (ICZN Art 72.4.1).

***Diplommatina yipingica* Zhang, sp. nov.**

<https://zoobank.org/09B25CA7-C670-4A5E-BE86-20E33C4DA1BF>

Material examined. *Holotype* SDNU.Gas.0337.01.001 (Figs 9, 13O); paratypes SDNU.Gas.0337.02 (Fig. 10) (coll. G. Zhang, 11 July 2018).

Type locality. Beijiushui, Laoshan, Qingdao City, Shandong Province, 36.205°N, 120.591°E, altitude 413 m a.s.l.

Description. Shell dextral, with about 5.5 whorls. Protoconch smooth, completely covered with small pits. Penultimate slightly expanded, body whorl nearly equal in width. Constriction at middle of parietal wall. No spiral striation visible. Teleoconch with strong, widely spaced, radial ribs; about 8–12 (9.8 ± 1.8) ribs per 0.5 mm on penultimate whorl, 5–9 (7.3 ± 1.9) ribs per 0.5 mm on body whorl. Dorsal fold absent. Umbilicus closed. Double lip absent. Columellar tooth present. Columellaris strong. One short horizontal palatalis just above columella. No vertical palatalis present. Shell with one palatalis and two parietalis; Prt1 shorter than Prt 2.

Diagnosis. Penultimate slightly expanded, body whorl nearly equal in width. Shell with one palatalis and three parietalis. Prt1 shorter than Prt 2.

Etymology. The name is derived from the Chinese word yiping [= yishengpingan], which means a fully peaceful and safe life.

Distribution. Known from type locality only.

Ecology. Lives in leaf litter. May climb up on plants after rain (Fig. 11).

Remarks. *Diplommatina yipingica* is similar to *Diplommatina pupinella*, *D. futilis*, *D. intermedia*, *D. paxillus longipalatalis*, *D. paxillus hunanensis*, *D. yunnannensis* and *D. schmackeriana* in terms of general shell shape. (Fig. 3). *Diplommatina schmackeriana* differs in having a smooth shell. *Diplommatina paxillus hunanensis* has more widely-spaced ribs. *Diplommatina paxillus longipalatalis* has weaker ribs. Lip morphology differs from species with a double lip, such as *D. futilis*.

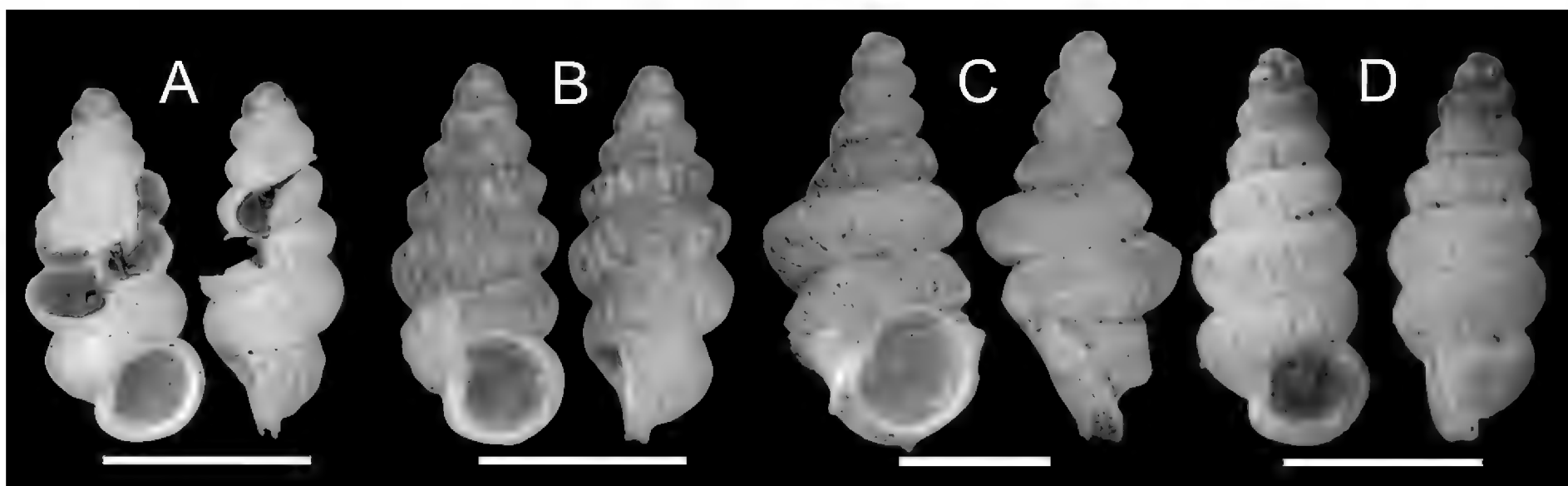


Figure 8. **A.** Holotype of *D. yunnanensis* IZCAS TM009566; **B.** Paratype of *D. yunnanensis* IZCAS TM009567; **C.** Holotype of *D. elbowforis* IZCAS TM008914; **D.** Lectotype of *D. herziana*, SMF39652. Scale bar = 1 mm.

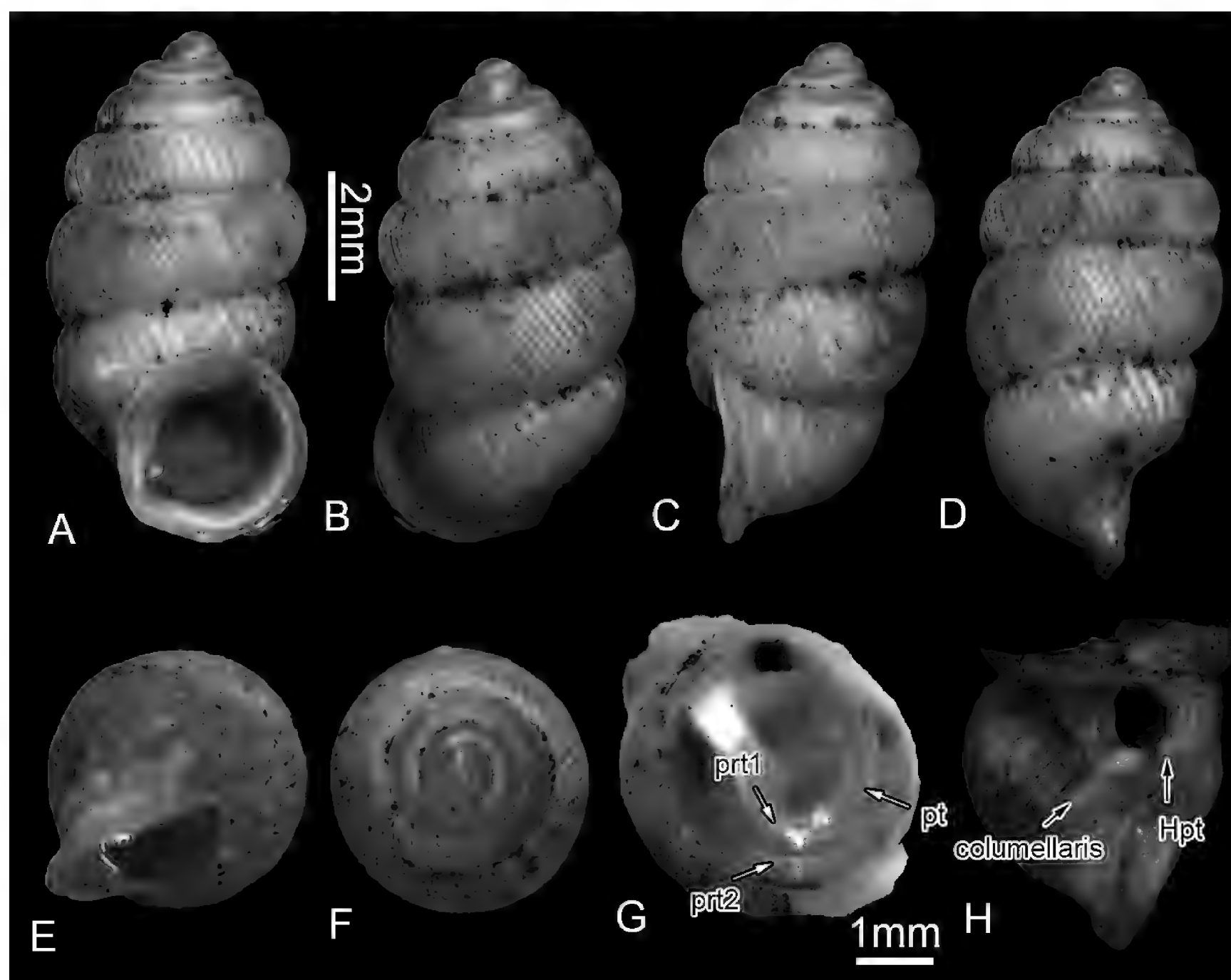


Figure 9. Type material of *Diplommantina yipingica* Zhang, sp. nov. **A–F.** Holotype of *D. yipingica* in apex, umbilicus, lateral, aperture and dorsal views. **G.** Palatalis and parietalis of new species; **F.** Columellaris of new species.

Additionally, the occurrence of *Diplommantina yipingica* is isolated far away from the known distributions of other congeners in China. The shell sizes of *D. kyobuntoensis* and *D. tyosenica* from the Korean Peninsula are significantly smaller compared to the new species. In both of these species, the penultimate whorl is broader than the body whorl (Kuroda and Miyanaga 1939). Similarly, the Korean species *D. changensis* and *D. chejuensis* also exhibit a wider penultimate whorl compared to the body whorl and have more whorls than new species (Kwon & Lee, 1991).

Species with questionable genus assignment

Diplommantina (?) *elbowforis* Chen & Zhang, 1998

Diplommantina elbowforis Chen & Zhang, 1998: 348. fig. 3

Type material. *Holotype* IZCAS TM008914 (Figs 8C, 13M), 86 paratypes IZCAS TM008915–00900, 160 paratypes IZCAS 009001–009160, nine paratypes IZCAS 155987–155995.

Type locality. Mengla, Yunnan.

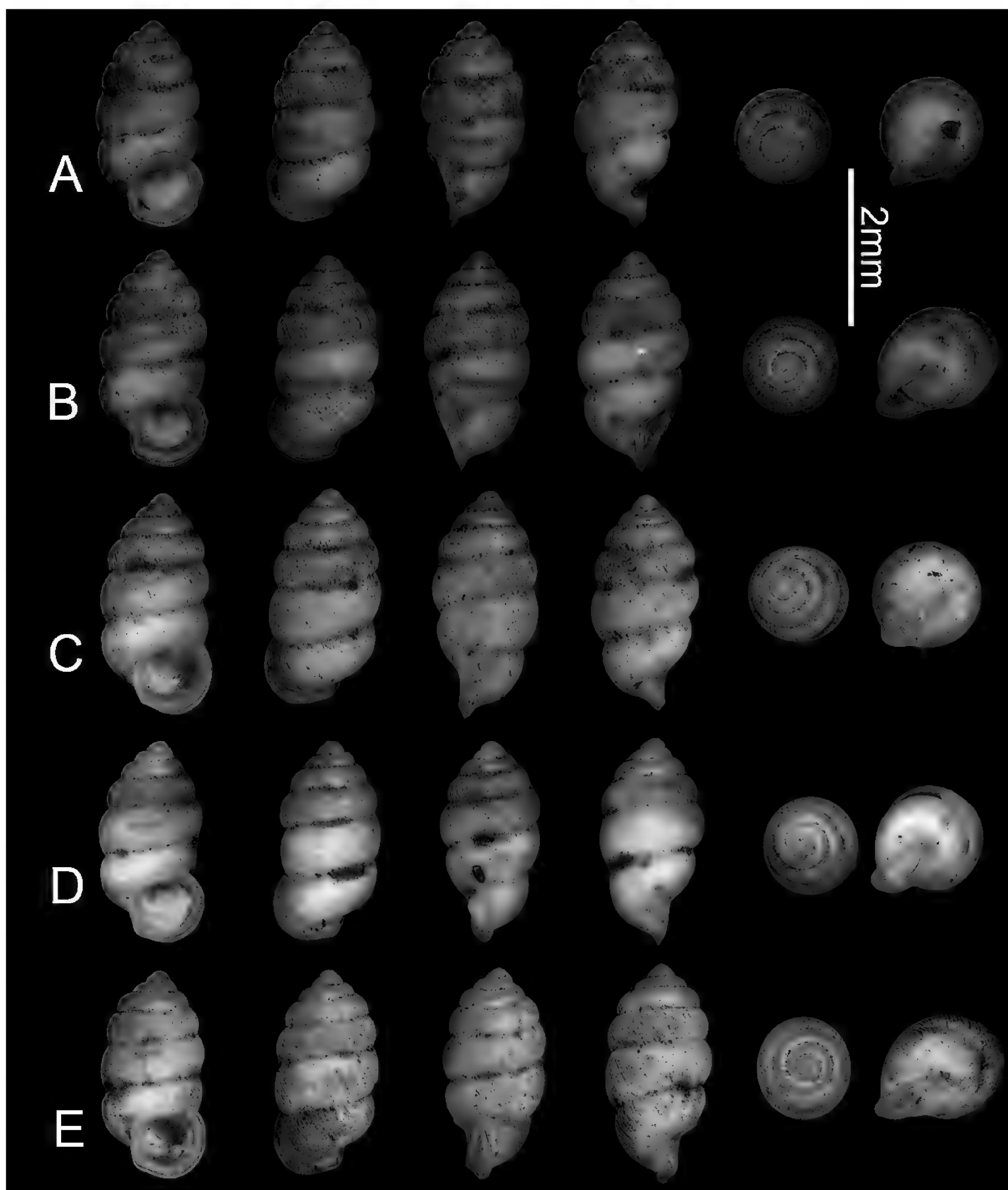


Figure 10. Paratypes of *Diplommatina yipingica* Zhang, sp. nov.

Brief description. Shell dextral, with about 7–7.5 whorls. Protoconch smooth. Penultimate whorl significantly expanded, slightly wider than body whorl. Teleoconch with strong, widely-spaced, radial ribs; with ca. 6 ribs per 0.5 mm on penultimate whorl and ca. 5 ribs per 0.5 mm on body whorls. Double lip present. Columellar tooth present. No horizontal palatalis nor vertical palatalis visible.

Remarks. In the original literature, 251 paratypes are mentioned. However, 255 specimens were deposited together and matched the collection locality and time in the literature, suggesting that the amount of the paratypes should be 255. (ICZN Art 72.4.1).



Figure 11. Living specimens of *Diplommatina yipingica*.

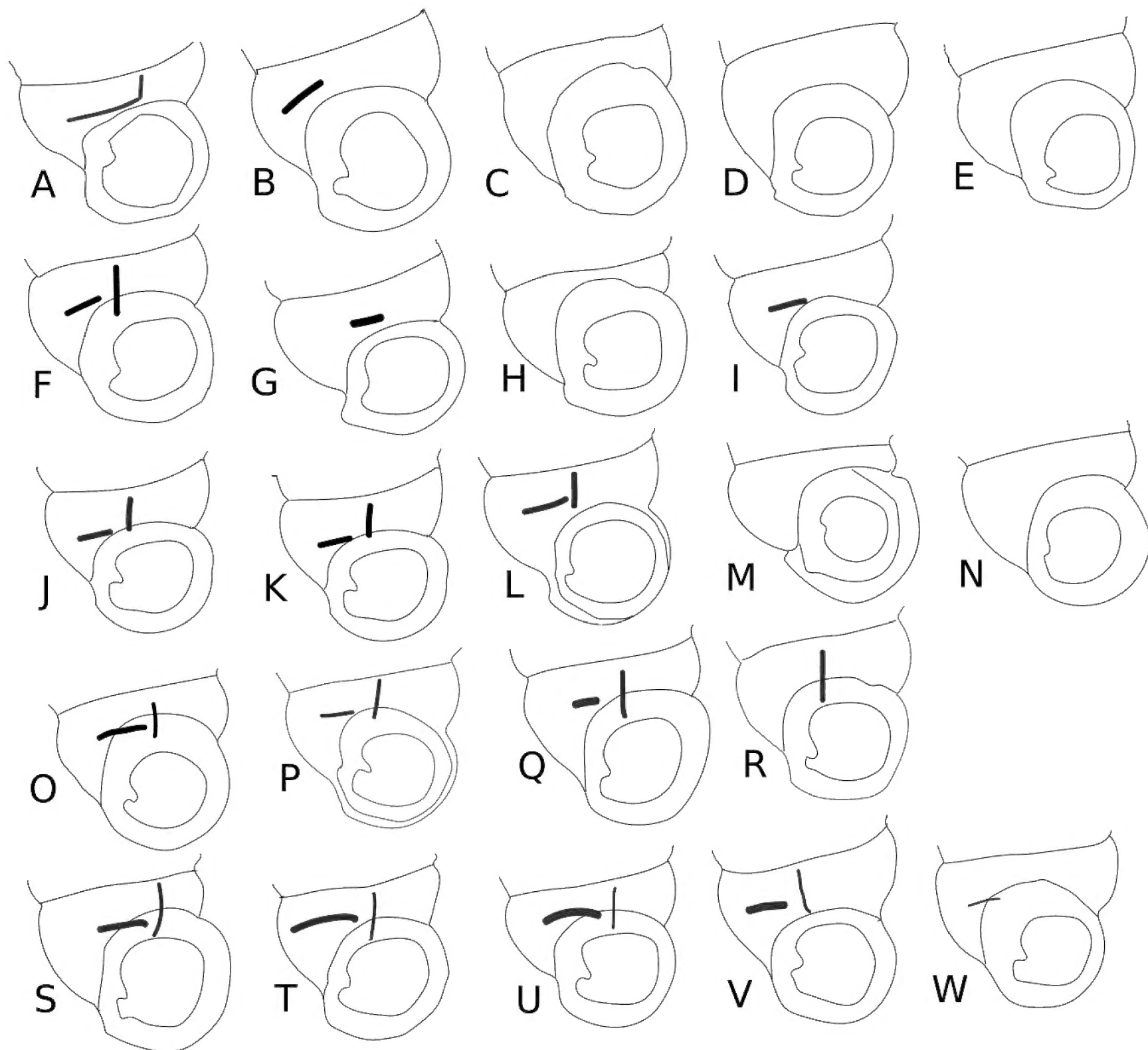


Figure 12. Parietalis of species of *Diplommattina*. **A.** *D. (Sinica) abbreviata*; **B.** *D. (Sinica) apicina*; **C.** *D. (Sinica) confusa*; **D.** *D. (Sinica) confusa*, not “form A”; **E.** *D. (Sinica) confusa*, not “form B”; **F.** Lectotype of *D. conica*; **G.** *D. consularis*; **H.** *D. (Sinica) contracta*; **I.** Paratype of *D. (Sinica) futilis*; **J.** *D. (Sinica) hangchowensis*; **K.** *D. hangchowensis granum*; **L.** *D. (Sinica) intermedia*; **M.** *D. liboensis*; **N.** *D. longxianensis*; **O.** *D. mangshanensis*; **P.** *D. (Sinica) minuscula*; **Q.** *D. paxillus*; **R.** *D. paxillus hunanensis*; **S.** *D. paxillis robusta*; **T.** *D. paxillus longipalatalis*; **U.** *D. mucronata*; **V.** *D. (Sinica) pupinella*; **W.** *D. (Sinica) pyra*.

***Diplommattina* (?) *herziana* Möllendorff, 1886**

Diplommattina herziana Möllendorff, 1886: 176–177. – Yen, 1939: 31, pl. 2, fig. 45.

Diplommattina (Eudiplommattina) herziana – Kobelt & Möllendorff, 1898: 137.

Diplommattina (Diplommattina) herziana – Zilch, 1953: 20, pl. 8, fig. 127.

Type material. *Lectotype* SMF 39652 (Figs 8D, 13N); 30 paralectotypes SMF 39653, 38 paralectotypes SMF 39654.

Type locality. “Hainan” [Hainan Province].

Brief description. Shell dextral, with about 7 whorls. Penultimate and body whorls nearly equal in width. Constriction not visible. Teleoconch with strong, widely spaced, radial ribs; ca. 7 ribs per 0.5 mm on penultimate whorl, ca. 8 ribs per 0.5 mm on body whorl. Dorsal fold absent. Umbilicus unknown. Double lips present. Columellar tooth indistinct. No horizontal palatalis nor vertical palatalis visible.

Remarks. Yen (1939) designated and figured the lectotype (SMF 39652). Zilch (1953) placed this species in *Diplommattina* proper. This species probably is not a member of *Diplommattina*. The character descriptions are based on the original description of the species.

***Diplommattina* (?) *luodianensis* Luo, Chen & Zhou, 2008**

Diplommattina luodianensis Luo, Chen & Zhou, 2008: 233–235, figs 1, 2.

Type material. Guizhou Normal University, not seen.

Type locality. Luodian, Dajin, Guizhou Province.

Brief description. Shell. Dextral. Protoconch smooth, about 7 whorls. Penultimate and body whorls nearly equal in width. Teleoconch with strong, widely-spaced radial ribs. Dorsal fold absent. Umbilicus small. Double lips present. Columellar tooth presents.

Remarks. No inner structures of *Diplommattina* can be seen. This species probably is not a member of

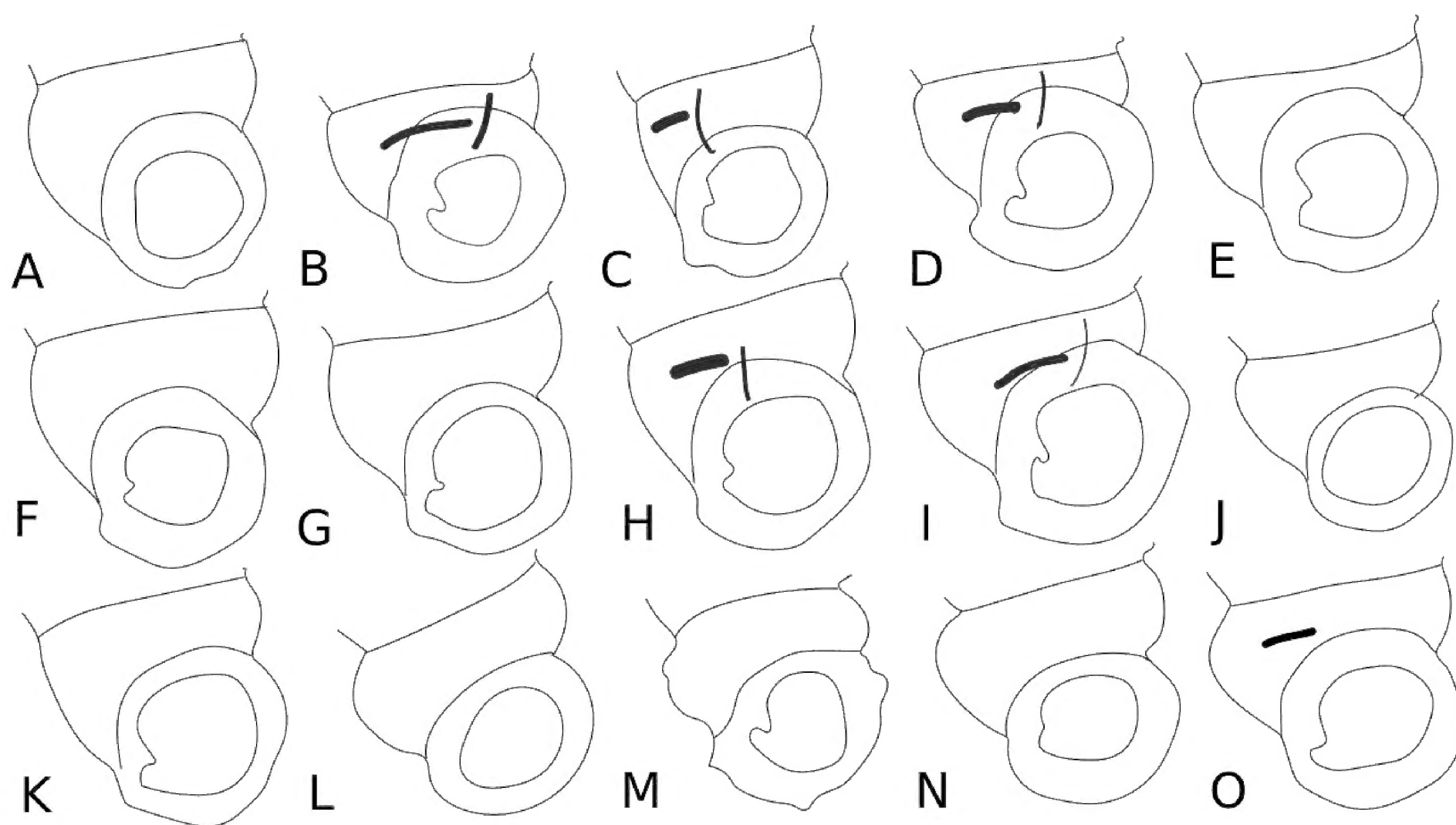


Figure 13. Parietalis of species of *Diplommattina*. **A.** *D. qinghensis*; **B.** *D. rufa*; **C.** *D. schmackeriana*; **D.** *D. (Sinica) sculptilis*; **E.** *(Sinica) setchuanensis*; **F.** *D. (Sinica) setchuanensis* HMT 228, not “form A”; **G.** *D. (Sinica) setchuanensis* HMT 228, not “form B”; **H.** *D. subcylindrica*; **I.** *D. triangulata*; **J.** *D. xiazayuensis*; **K.** *D. xingyinensis*; **L.** *D. yunnanensis*; **M.** *D. elbowforis*; **N.** *D. herziana*; **O.** *D. yipingica*.

Diplommattina. The character descriptions are based on the original literature for the species. The type specimens deposition in the main text, as stated in Guizhou Normal University, conflicts with the abstract that asserts this species was deposited at Guizhou Normal University and IZCAS.

***Diplommattina* (?) *xiaoqikongensis* Ran, Chen & Zhang, 1999**

Diplommattina xiaoqikongensis Ran, Chen & Zhang, 1999: 282, fig. 2.

Type material. IZCAS, not seen.

Type locality. Libo County, Guizhou.

Remarks. The genus assignment remains tentative for the insufficient information provided in the original description.

Discussion

Both morphological and molecular evidence support the recognition of the new species *Diplommattina yipingica* in our sample set. However, this geometric morphometric analysis is based on only one individual per species, except for *Diplommattina yipingica*, which leads to insufficient statistical significance. Geometric morphometric methods are effective for analysing shell variation from a phenetic perspective and can improve the application of shell morphology in

taxonomy. However, this approach requires substantial prior knowledge, because CVA can distinguish groups that PCA may not be able to (Dowle et al. 2015; Zhang and Wade. 2023). Previous studies on *Diplommattina* in China primarily rely on morphological characteristics and there are no molecular data available (Ran et al. 1999; Chen et al. 2001; Chen et al. 2002; Hu et al. 2003; Zhou et al. 2005; Luo et al. 2008). Subsequent studies should focus on more extensive sampling and utilise morphological and molecular evidence to revise *Diplommattina* in China. This can be done by integrating phylogenetics with morphology, verify traditional taxonomic characteristics and determining whether those characters are homoplastic or synapomorphic.

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References

- Baker B (1964) Type land snails in the Academy of Natural Sciences of Philadelphia, Part III. Limnophile and thalassophile Pulmonata. Part IV. Land and fresh-water Prosobranchia. Proceedings of the Academy of Natural Sciences of Philadelphia 116: 149–193.
- Bonfield JK, Beal KF, Betts MJ, Staden R (2002) Trev: a DNA trace editor and viewer Bioinformatics 18(1): 194–195. <https://doi.org/10.1093/bioinformatics/18.1.194>
- Boonmachai T, Bergey EA, Nantarat N (2023) First record and description of three new species in the land snail genus *Diplommatina* Benson, 1849 (Caenogastropoda, Diplommatinidae) from Satun Province, Thailand. Zoosystematics and Evolution 99(1): 195–207. <https://doi.org/10.3897/zse.99.99030>
- Budha PB, Naggs F, Backeljau T (2017) The genus *Diplommatina* Benson, 1849 (Gastropoda: Caenogastropoda: Diplommatinidae) in Nepal, with the description of seven new species. European Journal of Taxonomy 337: 1–30. <https://doi.org/10.5852/ejt.2017.337>
- Castresana J (2000) Selection of conserved blocks from multiple alignments for their use in phylogenetic analysis. Molecular Biology and Evolution 17(4): 540–552. <https://doi.org/10.1093/oxfordjournals.molbev.a026334>
- Chen D-N, Liu Y-H, Xu W-X, Yan Y-G (1994) Two new species of land snails from China (Prosobranchia; Mesogastropoda; Cyclophoridae). Sinzoologia 11: 43–46.
- Chen D-N, Zhang G-Q (1998) Description on new species and zoogeographical analysis of the land mollusks from xishuangbanna and neighboring area, Yunnan province (Gastropoda: Prosobranchia: Archaeogastropoda, Mesogastropod). Acta Zootaxonomica Sinica 23(4): 346–356.
- Chen D-N, Zhang G-Q, Liu X-Y (2001) Two new species of land snails in Xizang Autonomous Region, China (Prosobranchia: Mesogastropoda: Cyclophoridae). Acta Zootaxonomica Sinica 26(2): 166–169.
- Chen D-N, Zhang G-Q, Wang H-J. (2002) Two new species of land snails from Gansu Province, China (Prosobranchia; Mesogastropoda; Cyclophoridae). Acta Zootaxonomica Sinica 27(2): 221–224.
- Dowle EJ, Morgan-Richards M, Brescia F, Treweek, SA (2015). Correlation between shell phenotype and local environment suggests a role for natural selection in the evolution of *Placostylus* snails. Molecular Ecology 24(16): 4205–4221. <https://doi.org/10.1111/mec.13302>
- Egorov R (2013) Treasure of Russian shells Supplement 3. A review of the genera of the terrestrial pectinibranch molluscs Part III. Littoriniformes. Liareidae, Pupinidae, Diplommatinidae, Alycaeidae, Cochlostomidae. Colus Publications, Moscow, 61 pp.
- Gould AA (1859) Descriptions of new species of shells brought home by the North Pacific Exploring Expedition. Proceedings of the Boston Society of Natural History 7: 138–142. <https://doi.org/10.5962/bhl.part.4821>
- Gredler V (1881) Zur Conchylienfauna von China. II. Stück. Jahrbücher der Deutschen Malakozoologischen Gesellschaft 8: 10–33.
- Gredler V (1884) Zur Conchylien-Fauna von China. VI. Stück. Archiv für Naturgeschichte 50: 257–280.
- Gredler V (1885) Zur Conchylien-Fauna von China. VII. Stück. Jahrbücher der Deutschen Malakozoologischen Gesellschaft 12: 219–235.
- Gredler V (1886) Zur Conchylien-Fauna von China. IX. Stück. Malakozoologische Blätter 9: 1–20.
- Gredler V (1887a) Zur Conchylien-Fauna von China. X. Stück. Malakozoologische Blätter 9: 121–163.
- Gredler V (1887b) Zur Conchylien-Fauna von China. XIII. Stück. Jahrbücher der Deutschen Malakozoologischen Gesellschaft 14: 343–373.
- Greke K (2017) Taxonomic review of Diplommatinidae (Caenogastropoda) from Wallacea and the Papuan region. In: Telnov D (Ed.) Biodiversity, biogeography and nature conservation in Wallacea and New Guinea. Vol. 3, 151–316. [pls 119–147]
- Heude PM (1885) Notes sur les mollusques terrestres de la vallée du Fleuve Bleu. Mémoires concernant l’Histoire Naturelle de l’Empire Chinois 3: 88–132.
- Heude PM (1890) Notes sur les mollusques terrestres de la vallée du Fleuve Bleu. Mémoires concernant l’Histoire Naturelle de l’Empire Chinois 4: 125–188.
- Hu Z-Q, Yin H-Q, Chen D-N (2003) A new species of land snails from Mangshan, Hunan Province, China (Prosobranchia, Mesogastropoda, Cyclophoridae). Acta Zootaxonomica Sinica 28(2): 232–234.
- Hwang C-C, Chang K-M, Tada A (2009) Two new species of the land snail genus *Diplommatina* (*Benigoma*) Kuroda, 1928 (Gastropoda: Diplommatinidae) from Taiwan. Bulletin of Malacology 33: 21–36.
- International Commission on Zoological Nomenclature (1999) International Code of Zoological Nomenclature, 4th edn. International Trust for Zoological Nomenclature, London, xxix + 306 pp.
- Johnson RI (1973) Heude’s molluscan types of Asian land and fresh-water mollusks, mostly from the People’s Republic of China, described by P.M. Heude. Special Occasional Publication No. 1 (MCZ Harvard University Cambridge Mass.), 111 pp. <https://doi.org/10.5962/bhl.title.141074>
- Klingenberg CP (2011) MorphoJ: an integrated software package for geometric morphometrics. Molecular Ecology Resources 11: 353–357. <https://doi.org/10.1111/j.1755-0998.2010.02924.x>
- Kobelt W (1902) Das Tierreich. Eine Zusammenstellung und Kennzeichnung der rezenten Tierformen. 16. Lieferung. Mollusca. Cyclophoridae. Das Tierreich, Berlin (R. Friedländer), 662 pp. [34 pls + 1 map]
- Kobelt W, Möllendorff OF (1898) Katalog der gegenwärtig lebend bekannten Pneumonopomen. Nachrichtenblatt der Deutschen Malakozoologischen Gesellschaft 30: 129–160. <https://doi.org/10.5962/bhl.title.14877>
- Köhler F (2023) Peeking back in time: Novel insights into the evolutionary relationships of diplommatinids (Caenogastropoda, Cyclophoroidea) from around Australia. Zoologica Scripta 53: 78–86. <https://doi.org/10.1111/zsc.12629>
- Kozlov AM, Darriba D, Flouri T, Morel B, Stamatakis A (2019) RAxML-NG: a fast, scalable and user-friendly tool for maximum likelihood phylogenetic inference. Bioinformatics 35(21): 4453–4455. <https://doi.org/10.1093/bioinformatics/btz305>
- Kuroda T, Miyanaga M (1939) New Land Shells from Norther Tyosen (Korea). Venus 9(2): 66–85.
- Kwon OK, Lee JS (1991) New Land Snails in Korea. Korean Journal of Malacology 7(1): 1–11.
- Liew T, Vermeulen J, Marzuki M, Schilthuizen M (2014) A cybertaxonomic revision of the micro-landsnail genus *Plectostoma* Adam (Mollusca, Caenogastropoda, Diplommatinidae), from Peninsular Malaysia, Sumatra and Indochina. ZooKeys 393: 1–107. <https://doi.org/10.3897/zookeys.393.6717>

- Luo T-C, Chen D-N, Zhou W-C (2008) A new species of the genus *Diplommatina* Benson, 1849 from China (Prosobranchia, Mesogastropoda, Diplommatinidae). *Acta Zootaxonomica Sinica* 33(2): 233–235.
- Möllerndorff OF (1882) Materialien zur Fauna von China. *Jahrbücher der Deutschen Malakozoologischen Gesellschaft* 9: 337–356.
- Möllerndorff OF (1885a) Diagnoses specierum novarum sinensium. *Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft* 17: 161–192.
- Möllerndorff OF (1885b) Materialien zur Fauna von China. *Jahrbücher der Deutschen Malakozoologischen Gesellschaft* 12: 349–411.
- Möllerndorff OF (1886) Materialien zur Fauna von China. *Jahrbücher der Deutschen Malakozoologischen Gesellschaft* 13: 156–210.
- Nakamura T, Yamada K, Tomii K, Katoh K (2018) Parallelization of MAFFT for large-scale multiple sequence alignments. *Bioinformatics* 34(14): 2490–2492. <https://doi.org/10.1093/bioinformatics/bty121>
- Neubert E, Bouchet P (2015) The Diplommatinidae of Fiji—a hotspot of Pacific land snail biodiversity (Caenogastropoda, Cyclophoroidea). *ZooKeys* 487: 1–85. <https://doi.org/10.3897/zookeys.487.8463>
- Nurinsiyah AS, Hausdorf B (2017) Revision of the Diplommatinidae (Gastropoda: Cyclophoroidea) from Java. *Zootaxa* 4312(2): 201–245. <https://doi.org/10.11646/zootaxa.4312.2.1>
- Palumbi S, Martin A, Romano S, Mcmillan WO, Stice L, Grabowski G (1991) The Simple Fool's Guide to PCR. Department of Zoology, University of Hawaii, Honolulu, 1–45.
- Pilsbry HA (1934) Zoological Results of the Dolan West China Expedition of 1931. Part II. Mollusks. *Proceedings of the Academy of Natural Sciences of Philadelphia* 86: 5–28.
- Pilsbry HA, Hirase Y (1908) New land shells of the Chinese Empire: I. *Proceedings of the Academy of Natural Sciences of Philadelphia* 60: 37–43.
- Ran J-C, Chen D-N, Zhang G-Q (1999) Two new species of land snails from China (Prosobranchia: Mesogastropoda: Cyclophoridae). *Acta Zootaxonomica Sinica* 24(3): 281–284.
- Rohlf FJ (2004) tpsUtil, file utility program, version 1.26. Department of Ecology and Evolution, State University of New York at Stony Brook. <https://life2.bio.sunysb.edu/ee/rohlf/software.html>
- Rohlf FJ (2005) tpsDig, digitize landmarks and outlines, version 2.05. Department of Ecology and Evolution, State University of New York at Stony Brook.
- Ronquist F, Teslenko M, Van Der Mark P, Ayres DL, Darling A, Höhna S, Larget B, Liu L, Suchard MA, Huelsenbeck JP (2012) MrBayes 3.2: efficient Bayesian phylogenetic inference and model choice across a large model space. *Systematic Biology* 61(3): 539–542. <https://doi.org/10.1093/sysbio/sys029>
- Schmacker B, Boettger O (1890) Neue Materialien zur Charakteristik und geographischen Verbreitung chinesischer und japanischer Binnenmollusken 1. *Nachrichtsblatt der Deutschen Malakozoologischen Gesellschaft* 22: 113–144.
- Staden R, Judge DP, Bonfield JK (2003) Managing sequencing projects in the GAP4 Environment. Introduction to bioinformatics. In: Krawetz SA, Womble DD (Eds) *Introduction to Bioinformatics*. Human Press, Totawa, 327–344. https://doi.org/10.1007/978-1-59259-335-4_20
- Thiele J (1929) *Handbuch der systematischen Weichtierkunde* (Teil 1), part 1. Gustav Fischer Verlag, Jena, 778 pp.
- Webster NB, Van Dooren T, Schilthuizen M. (2012) Phylogenetic reconstruction and shell evolution of the Diplommatinidae (Gastropoda: Caenogastropoda). *Molecular Phylogenetics and Evolution* 63(3): 625–638. <https://doi.org/10.1016/j.ympev.2012.02.004>
- Wenz W (1939) Gastropoda. Teil I: Allgemeiner Teil und Prosobranchia. In: Schindewolf OH (Ed.) *Handbuch der Paläozoologie*. Vol. 6. Borntraeger, Berlin, 241–480 (issue 2, 1938) + 481–720 (issue 3, 1939).
- Winston JE (1999) *Describing species: practical taxonomic procedure for biologists*. Columbia University Press, 512 pp.
- Yamazaki K, Yamazaki M, Ueshima R (2013) Systematic review of diplommatinid land snails (Caenogastropoda, Diplommatinidae) endemic to the Palau Islands. (1) Generic classification and revision of *Hungerfordia* species with highly developed axial ribs. *Zootaxa* 3743(1): 1–71. <https://doi.org/10.11646/zootaxa.3743.1>
- Yen T-C (1939) Die chinesischen Land- und Süßwasser-Gastropoden des Natur-Museums Senckenberg. *Abhandlungen der Senckenbergischen Naturforschenden Gesellschaft* 444: 30–33.
- Zhang G, Wade CM (2023) Molecular phylogeny and morphological evolution of the Chinese land snail *Cathaica* Möllerndorff, 1884 (Eupulmonata: Camaenidae) in Shandong Province, China. *Biological Journal of the Linnean Society* 140(4): 556–577. <https://doi.org/10.1093/biolinnean/blad067>
- Zhou W-C, Chen D-N, Li Y (2005) A new species of the genus *Diplommatina* Benson, 1849 from China (Prosobranchia, Mesogastropoda, Cyclophoridae). *Acta Zootaxonomica Sinica* 30(4): 725–727.
- Zilch A (1953) Die Typen und Typoide des Natur-Museums Senckenberg, 9: Mollusca, Cyclophoridae, Diplommatininae. *Archiv für Molluskenkunde* 82(1–3): 1–85.
- Zilch A (1974) Vinzenz Gredler und die Erforschung der Weichtiere Chinas durch Franziskaner aus Tirol. *Archiv für Molluskenkunde* 104(4–6): 171–228.